★ ★

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Women are quick to appreciate the beauty of a kitchen range equipped with Durez handles, buttons and knobs in color . . . and the comfortable assurance that these fixtures never become too warm for the hand.

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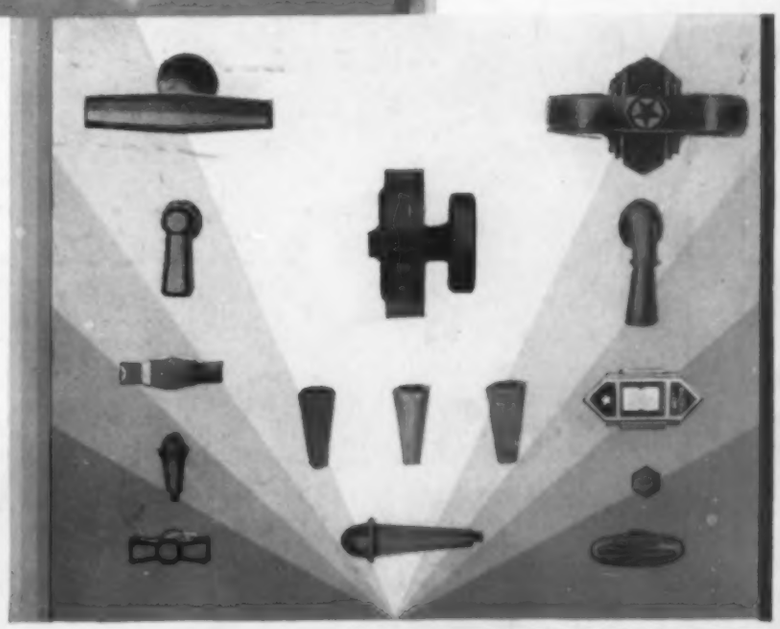
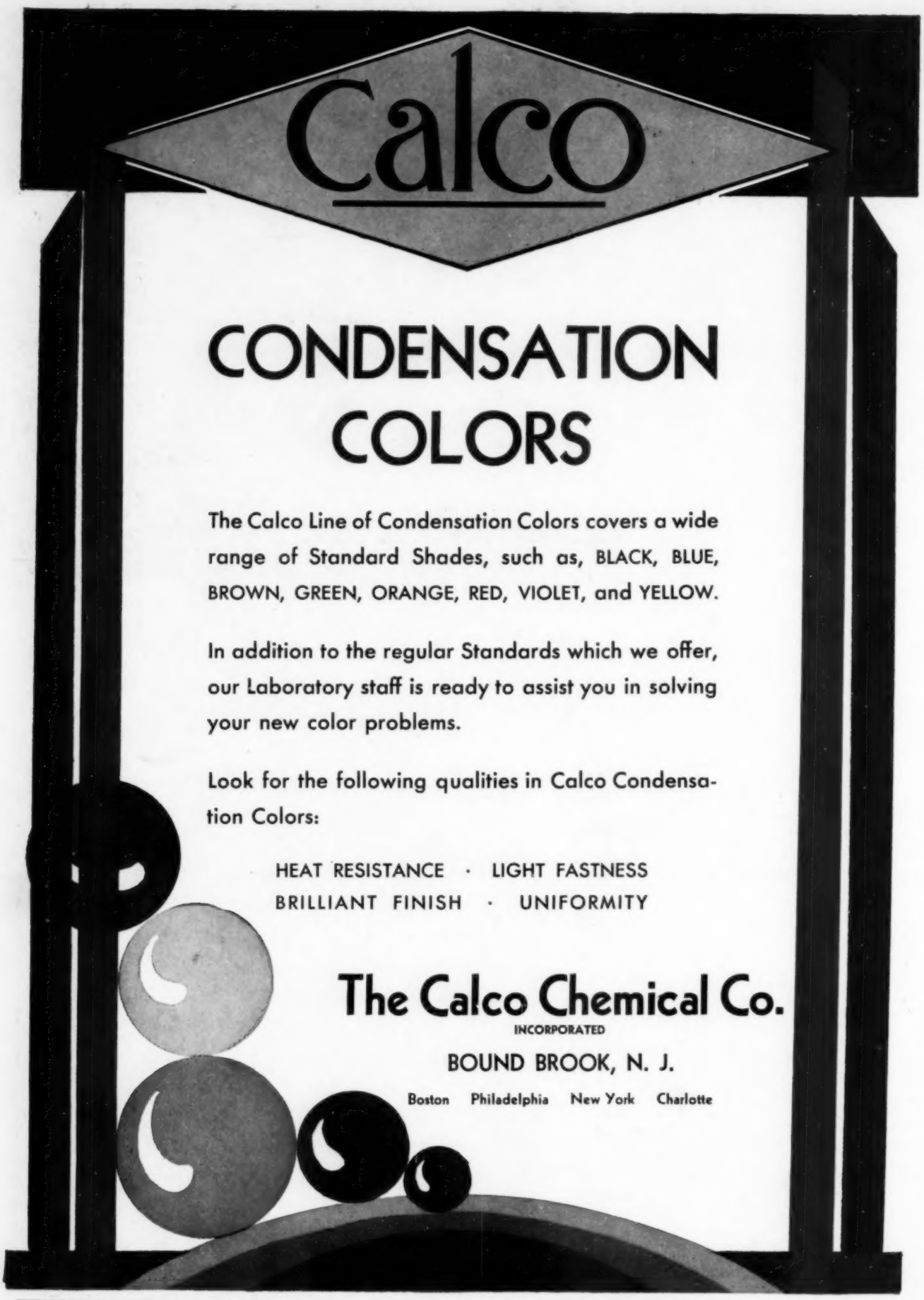
Durez fixtures are light and strong, wear indefinitely, and virtually never crack. A wide variety of designs.



This interesting free booklet—"Do It With Durez"—contains complete information about Durez, giving physical and dielectric properties, color ranges, and listing scores of possible applications.

DUREZ
The perfect molding compound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PLASTICS & MOLDED PRODUCTS

Reg. U. S. Pat. Off.

Volume 7 **AUGUST 1931** **Number 8**

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PLASTICS & MOLDED PRODUCTS

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Volume 7 AUGUST, 1931 Number 8

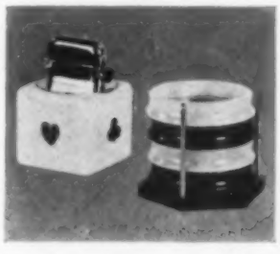
WE present the second in our series of new applications of plastic materials and hope for an ever-widening sphere of usefulness to buyers of these products. Through correspondence and conversations we learn that information has been sought on some of the articles depicted and what is more pertinent, featuring one actual production job on this page has prompted manufacturers to visualize the application of some plastic material to new products in the development stage. Synthetic plastics have countless possible uses. The purpose of these pages is to foster this growth.

• • •

CLOSURES get preference on this page because everyone uses bottles and the superiority of molded resinoid can be readily appreciated. Attractiveness is a prime requisite and these Durez closures have it. With the present boom in the antiseptic and nail polish fields, cap-and-applicator units find much favor. Among those shown are included the recessed and quill prong type, molded by Colt's Patent Fire Arms Mfg. Co. and Mack Molding Co., the latter merchandised through the Armstrong Cork Co. On the right are shown the new Owens-Illinois Glass Co.'s modernized prescription bottle. These carry a specially-designed, patented cap molded by Colt's out of Durez.

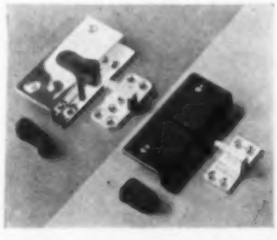
• • •

To those whose sense of beauty is satisfied by highly-polished natural stones, the warmth and luster of translucent phenolic resinoid solids provides an oft-adequate substitute. These materials can be made to simulate onyx, jade, marbles, coral and other semi-precious stones.



The two illustrations show applications that may be placed in the "luxury" class. A turned cigarette jarette with an ash tray to match. The other a bridge set consisting of suitably decorated lighter and a nest of ash trays. Fabricated by Apex Specialties Co. Material is Marblette.

• • •



In these times, few objects are subject to more wear than the office ledger. Phenolite, National Vulcanized Fibre Co.'s laminated resinoid sheet stock, provides a cover that has many years' wear in it. Stock used is 3/16 inch fabric base, the surface finished in a mahogany grain.

Automobile doors which close quietly, and securely, stay closed, and open easily, are an asset to the owner. As replacement for rubber and metal, the bumpers in this dovetail device developed by the Mitchell Specialty Co. Bakelite molded supplements the improved tapered design, completing an improvement, which seemingly has long been sought.

Molded boxes, either for package ensembles or general purposes, best indicate the progress made with phenol resinoid materials in the applied arts. In this Bakelite molded box, the beautifully rounded corners, snap closing, and decorative top with inlay effect, combine to characterize one of the best examples of molder's art in this particular field.

LAWMAKERS have placed their seal of approval on two plastic materials. In Detroit, an Official Ruling requires that non-metallic plates be used for convenience outlets and switches of the flush type. Resinoid molded parts have been used in great quantities in both these applications. A Michigan law requires every automobile manufactured in that state to be fitted with shatter-proof glass. Pyroxylin Plastic sheeting is the middle layer in safety glass.

Pyroxylin has long been used in the production of unbreakable watch crystals. Another plastic, transparent phenolic resinoid, comes up as a competitor. The Lindhe, Bakelite, break-proof crystal is manufactured by Henry E. Lindhe, Inc., 159 N. State Street, Chicago, Illinois. The manufacturers announce the outstanding feature of the crystal to be that it combines the best qualities of both the glass and the "unbreakable" type, and that the crystals are water-white, highly lustered, perfectly domed, hard, tough, and when fitted stay in the bevel.

• • •

Great molded ideas often emanate from the West. Recently we saw a beach sandal molded in pastel Durez. Now we have a molded flower pot and coaster set. Molded by Universal Molding Co., San Francisco, Cal. The material used is Durez. No inside pots are necessary because the compound does not affect the plants. In fact, the molders claim that some plants grow better in molded than in clay pots. Soil drains through a hole in the bottom.

• • •

Majestic Refrigerator has fallen in line with other well-known mechanical ice-chests and has adopted the laminated resinoid strips on door jams and sills. The advantages are obvious—heat insulating properties, imperviousness to dirt and moisture, good mechanical strength. Deodorized material prevents food contamination. Phenolite, National Vulcanized Fibre Co.'s product used. Photo Courtesy Peirce-Phelps Co.

The use of molded materials in sink strainers represents an example of perfect adaptation of material to purpose. The advantages of molded resinoids are several. It will not chip like enamel, or become battered and tarnished like aluminum. In contact with the hard finish of the sink, the molded strainer is not noisy, and in contact with the hands, the material is more pleasant to touch than metal or enamel. Molded and merchandised by Norton Laboratories, Lockport, N. Y. Materials used have been Bakelite, Durez and Aldur. Photo Courtesy Bakelite Corp.

• •

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Custom molders are an ingenious lot—their ingenuity generally having a double-edged benefit. In the Dr. West combination shown here, Colt's supplies two molded closures for the carrying tube. Holes are drilled in stock caps—thus saving the customer extra mold costs. But by supplying *two* caps on a straight, threaded tube, Dr. West has a sanitary container, the *two*, drilled caps providing ventilation to keep the brush from remaining wet—a wet toothbrush being good breeding ground for bacteria. Material used is Durez.

• • •

SPEAKING of closures prompts us to wonder if we can look forward to having our Eau de Heliotrope poured on our thinning locks through molded sprinkler tops. And watch crystals reminds us that a dollar ticker might look better in a molded case instead of in a plated case which shows the brass underneath. But we sha'n't ask for silent laminated gears inside. We understand that Kurz-Kasch, Dayton, Ohio, is turning out an all-molded ledger for International Visual Record. We wish to correct two errors in the July Section. American Insulator Corp., New Freedom, Pa., developed and molded the Archdale Razor case credited to Northern Industrial Chemical Co. And the Therm-O-Clock Co. is in Springfield, Ohio.

Reprints of these pages for other members of your company may be obtained from Plastics Publications, Inc., 114 East 32 Street, New York.

The Manufacture of Resinoid Grinding Wheels

By Curtis I. Kohn

This article contains a short history of grinding wheels with a brief description of the manufacture of the principal artificial abrasives. This is followed by a more detailed description of the manufacture of resinoid bonded wheels including preparation of the batch, methods of pressing, curing schedule and finishing operations, concluding with various applications and methods of making the proper wheel selection.

THE use of grinding wheels dates back to the earliest historical records. These early wheels were hewn out of natural rock, chiefly sandstone and provided what are known as grindstones. However the manufacture of artificial abrasive wheels, which is now by far the most important part of the industry, began about seventy years ago. Swen Pulson, in association with F. B. Norton and F. Hancock, stoneware manufacturers of Worcester, Mass., pioneered in the manufacture of emery wheels with a vitrified clay bond. In 1859, patents were issued to T. J. Myall of Roxbury, Mass., for the manufacture of rubber bonded wheels. About 1868, Gilbert Hart made wheels by bonding emery with clay and silicate of soda, the latter substance being better known as water glass. Still later, in 1876, Richardson produced a shellac bonded wheel for grinding watch tools.

Silicon Carbide, known variously as electrolon, carborundum and crystolon, and artificial aluminous abrasives, under the trade name of alundum, aloxite and borolon form the principal artificial abrasives. Silicon Carbide, which has never been discovered in the natural state on this planet, altho it has been found in some meteorites, and artificial alumina, developed from the search for synthetic gems. The discovery of crystalline Silicon Carbide is accredited to Dr. Acheson of Monongahela, in western Pennsylvania, who produced a few crystals in a small electric furnace while trying to make synthetic diamonds and hard abrasives. The raw materials were chiefly carbon and clay (an oxide of aluminum), hence he called the new substance "carborundum" from carbon and corundum, a natural crystalline oxide of aluminum. Analysis proved this new material to be composed of silicon and carbon. With this knowledge, Acheson improved his method, and in 1891 a patent was issued to him for its manufacture. From an original daily output of four ounces and a price of forty cents a carat or eight hundred eighty dollars a pound, its manufacture increased until the present annual production is approximately twenty-five thousand tons at a price of about 10c a pound.

The present method of manufacture of silicon carbide varies but little from that set forth by Dr. Acheson in his patent application. Crushed coke and silica sand are charged into an electric furnace with small quantities of salt and sawdust, and at a temperature from 2800°F-2300°F, the silicon from the sand combines with the coke to form silicon carbide. The salt acts as a flux and the sawdust which burns out, helps to make the product more porous. Silicon carbide is the hardest artificial abrasive known and stands next to diamond in this property. It varies in color from a gray green to black and is quite brittle. The reason for the variation in color is not entirely known, altho it can be controlled to some extent by process of manufacture. A pure green silicon carbide known as Sika is made in Scandinavia and is the most brittle. The lump silicon carbide is crushed to about eight or 10 mesh and is then treated to remove various impurities. First, by means of steam, air and water the graphite is floated off. Caustic soda and steam are added in the next step to dissolve silicon, silicides, and some additional graphite set free here is also removed. Sulphuric acid is then added to neutralize the caustic soda, followed by an addition of hydrochloric acid to dissolve any free iron.

The mass is then washed with water and the overflow from the screw type washer contains the flour grades. These are separated by elutriation, dried and stored. The sludge from the washer is then dried first by draining, followed by passage through a cylindrical drier. The dried material is then passed over a magnetic separator, after which it is practically iron free, containing less than .05% iron. It is now ready for preliminary grading after which it is crushed again and finally graded. By grade is meant the size of the individual grain, as determined by the size mesh it will just pass through. There are about 25 sizes or grades varying from six

to two hundred and twenty as well as the various flours.

The development of artificial aluminous abrasives dates from 1837 when M. A. Gaudin produced rubies by fusing a mixture of alum and potassium sulfate at a high temperature in a carbon crucible. The first commercial manufacturing of artificial corundum began in 1894, several years after silicon carbide, when Hasslacher of Germany made this substance from emery. The following year, Werlein used calcined bauxite, a hydrated oxide of aluminum as his raw material, and it is this substance, bauxite, which is the source of the bulk of artificial aluminous abrasives of the present day. A mixture of crushed and calcined bauxite together with coke and iron borings is subjected to the intense heat of an electric arc furnace for about twenty-four hours. The iron combines with the silicon present forming ferro-silicon which is removed as a button. The fused alumina is then crushed and magnetic impurities are removed.

The alumina is next crushed to lumps about the size of a fist and large impurities are removed by hand. It then goes through a jaw crusher followed by roll crushers until the size is reduced to about six mesh. At this point a magnetic separator is used and the cleaned material is roasted in a furnace. Next it goes through a Dorr classifier and the overflow is run into tanks. The fines settle to the bottom and are removed and dried. The remaining grain passes in turn through a shell drier and then a magnetic separator for final removal of free iron. The non-magnetic grain is now ready to be graded in a manner similar to that of silicon carbide. Fused aluminous abrasive is not as hard as silicon carbide, but is much tougher and for this reason is used for grinding materials of high tensile strength, such as manganese steels, whereas silicon carbide wheels are used chiefly for substances of lower tensile strength like aluminum, bronze, etc. There is a "special aluminous abrasive" which has properties between those of silicon carbide and the regular aluminous abrasives and which finds wide usage, especially in tool and knife grinding and in certain types of saw gumming. This abrasive is a very pure form of alumina, containing over 99% aluminum oxide, whereas the regular aluminous may contain up to 5% impurities. This abrasive may be made by fusing natural corundum or precipitated alumina, the latter yielding a product of extremely high purity and practically white in color.

The manufacture and use of silicate, vitrified, rubber and shellac bonded wheels have steadly developed, but it was not until comparatively recently that a very important stride was made in the industry. Dr. Baekeland, in 1909 announced the discovery of phenol-aldehyde condensation resins. Redman, Novotny, Aylsworth, Martin and Brock were other early workers in this field, which developed rapidly and gave the abrasive industry a new bond. Progress and growth of this type of wheel have followed until resinoid bonded wheels now form a large percentage of grinding wheel production.

In detail the manufacture of phenol resinoid bonded wheels varies in different plants, but the principle is the same. The grit is wetted with a plasticizer to which the resinoid is then added and the mass mixed. The wheel is then molded under hydraulic pressure and baked. After drawing from the oven it is ready to be machined to size, tested and shipped.

The desired grit, either in a single size, or more frequently a combination of several sizes is weighed, put in the bowl and mixed in a mixer of the dough type. Next the plasticizer is added and mixed with the grain. Finally the powdered resin with or without some filler, such as flint, is added and mixed. The individual grains must be wet with some substance so that the resin particles will adhere to their surface. Halowax oil, a chlorinated napthalene, was one

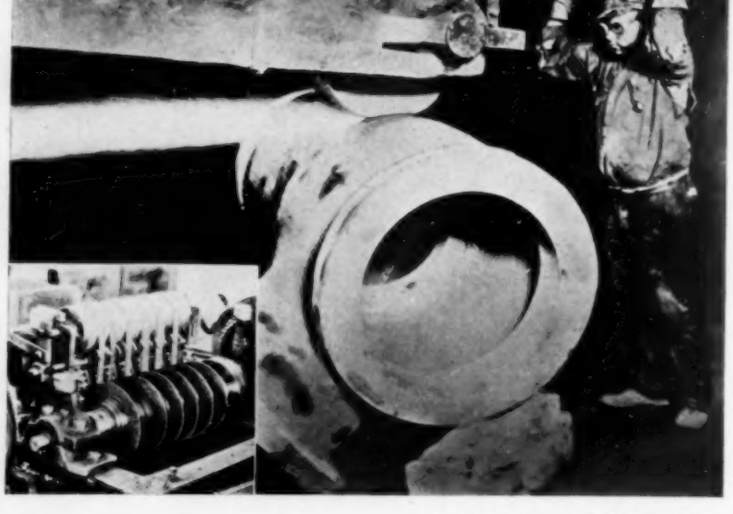

Photo Courtesy Bakelite Corp.

Mechanical shop practice in a wide range of industry requires that aluminum alloy, and cast iron machine elements be snagged and finished by abrasive wheels. It is the grit (frequently silicon carbide or aluminum oxide) which does the cutting, but the bond is equally important. Resinoid bond has made possible increased cutting speed—advance from 6,000 to 9,000 surface feet per minute being common. Other principal types of bond are: vitrified, rubber, and shellac. (Insert) Gang cutter used to cut carbons to specified lengths within tolerances of 1-64"; operation at 7,450 s. f. p. m.

of the early wetting agents. A mixture of furfural with creosote oil or cresols is widely used at present, as well as certain liquid resins. The amount of plasticizer used is governed by the viscosity of the resin, the grain size, the amount of resin and atmospheric conditions, the latter being a specially important factor when furfural and the cresols are used. Viscosity is determined by dissolving ten grams of resin in fifty cubic centimeters of solvent. The solution maintained at a definite temperature is allowed to flow through a burette and the time of flow in seconds is taken as the viscosity. In warm, humid weather the amount of plasticizer must be decreased considerably, otherwise the mix will be "wet" resulting in the formation of a solid, plastic mass, which must be broken up and forced through a screen. Too prolonged mixing also produces a wet mix. If it is still lumpy after screening it must be combined with a "dry" batch or discarded. Insufficient plasticizer results in an ununiform mix as the grain is not wet enough to hold the resin on its surface and during mixing it (resin) sifts through to the bottom of the bowl.

The mix is then poured at a moderate rate into the mould which is mounted on an electrically operated turntable. This aids in the distribution of the grit and bond throughout the wheel resulting in a wheel of more uniform structure. The material in the mould is then levelled. An improvement here is the development of a mechanical levelling device, which consists of a rectangular blade bolted to an inverted "L" shaped arm. The horizontal member of the L is hinged to a plate on the upper part of the press frame, permitting movement over the turntable in a plane parallel to the platens. The other member to which the blade is attached is connected to the horizontal member by a ratchet arrangement which allows motion in a vertical direction, which motion is governed by a hand operated crank. The levelling blade is generally adjusted to a slight angle with the horizontal so that before pressing, that part of the wheel next to the hole will be from one-eighth to one-quarter inch thicker than the outside. Since, of course, the sides of the wheel are pressed parallel, more material is pressed in that part near the hole, resulting in this portion being denser than that near the outside or face. This is done to make the cutting action of the wheel more uniform as it wears down and will be further explained later. The top plate of the mould is then put on, followed by the pressing spider or rings, and the wheel is then slid on to the press.

Pressing Methods

The pressing may be done in either of two ways, either "pressed to pressure" or to a definite density. By the first method the wheel is pressed generally from one half to two tons per square inch depending upon whether a wheel of open or tight structure is desired. The latter method is in general more satisfactory and consists of pressing a definite weight to a definite volume regardless of the pressure required. This may be done by pressing in a close-up mould, that is by applying pressure until the mould is closed; or by placing steel blocks of the required height in the four corners of the bottom platen to fix in this way the pressed thickness of the wheel. By pressing to density, uniformity of structure is more readily obtained. When wheels are pressed to pressure the structure is not so likely to be constant. A wheel pressed on a cool, clear day will have a tighter or more dense structure than one made on a humid day, since more plasticizer will be used in the former case. In making thin wheels (one-sixteenth to one-half inch in thickness) it is more difficult to use a mechanical levelling device and the straight edge is still used. The pressed wheel should not vary more than .010" in thickness and cutoff wheels .005".

The wheels are set on vitrified batts either in the open or in cans and embedded in sand. If set in sand they are strapped down or held down by heavy plates. Hard wheels which contain a high percentage of bond, and those of dense structure must be set in sand, otherwise part of the resin, softened by heating, would run out making the wheel worthless. Cutoff wheels may be set in the open between plates.

Whereas the cure of most moulded products takes place in the mould and is a matter of minutes, the burning schedule of resinoid grinding wheels often extends to fifty hours, depending on the size of the wheels, as the cure must be carried to an advanced stage.

The wheels are set in electrically heated ovens in which a good circulation of air is maintained by fans so that the temperature in various parts will not vary more than 10°F. Recording thermometers and automatic temperature controllers are used. A typical schedule for large wheels set in sand starts at 200°F and held for twelve hours. The temperature is then gradually raised for fourteen hours until it reaches 400° and then is held at this temperature fifteen hours. Abrasive wheels are subjected to severe usage, a snagging wheel 24" in diameter, 3" thick with a 12" hole and weighing about 100 pounds being operated at 1400 R. P. M. or 9000 surface feet per minute. They must be able to withstand tremendous strains and it is necessary that they be cured to develop great strength. Too long exposure to high heat causes the wheel to become brittle and decrease in toughness. In grinding, the strains on the wheel are chiefly of a tensile nature, due to the high operating speed, and shock, under which conditions a brittle wheel may break. When a snagging

wheel on a swing frame grinder breaks it recalls an event of one of Bret Harte's characters when "A piece of red sandstone hit him in the abdomen and the ensuing proceedings interested him no more." The tensile strength of a hard resinoid wheel is around 2000 pounds per square inch, varying of course with the grit size and grade of the wheel.

The degree of cure is checked in the laboratory by treating a piece of the test wheel in a flask with boiling acetone for one hour. At the end of this time the filtered solution should be colorless or colored a very pale yellow, and the test piece should be intact and exhibit no tendency to crumble when rubbed by the hand. A deeper color or disintegration denotes undercure.

After the wheels are drawn from the oven they are sent to the finishing room. First the sides are machined to bring the wheel to the desired thickness. The holes are then cut to size or bushed as the case may be, and finally the wheels are faced, that is machined to diameter. Close tolerances must be observed and the wheels are inspected for size and grade. By the grade of a grinding wheel is meant the tenacity with which the bond holds the grain and is measured by "digging". A tool similar in shape to a screw driver is pressed against the side of the wheel with a twisting motion. The depth of penetration and the ease or difficulty with which this is accomplished determines the grade or hardness of the wheel, a hard wheel allowing but a slight penetration.

Grading of Wheels

Grading requires considerable experience as the action is different not only with the different bonds but with different grain sizes with the same bond. In addition the person grading the wheel is guided by its sound or ring. The higher the pitch, the harder the wheel is. About two years ago the Abrasive Engineering Co., of Detroit introduced a mechanical grading device called the Gradeometer, which indicates the depth of impression made by a series of equal blows of a blade similar to a digger blade on the side of the wheel. This is of value but has its limitations and does not supplant hand grading.

Following the finishing operations, the wheels are balanced and truth tested for parallel sides and roundness. A wheel is tested for balance by putting a well fitting spindle through the hole and then set on trunnions. If the wheel is in perfect balance it will remain stationary in any position it is set, otherwise it will come to rest with the heavy part on the bottom. Weights are then attached at a point directly opposite the heavy side and near the periphery until it is balanced. The number of ounces required to do this is known as the amount out of balance at the face. If the out of balance exceeds the tolerance for that particular type of wheel an opening may be cut at the center of the wheel on the light side, and enough lead poured in to bring the wheel within allowable limits. This is not entirely satisfactory, since the wheel may get out of balance again as it is worn down. An excessive out of balance condition causes pounding which results in uneven grinding, and at the high operating speeds of resinoid bonded wheels may result in wheel breakage. Out of balance may be due either to poor finishing or ununiform structure. Truth testing with the maintenance of close tolerances provides a check on the former, while by proper distribution of the material in the mould, the latter tends to be prevented. Proper preparation of the batch followed by filling the mould at a moderate rate on a revolving turntable, mechanical levelling, and finally, pressing so that the sides of the wheel are parallel produces a uniform structure. By maintaining the moulds and all pressing equipment in first class condition this result is obtained. Adherence to these factors in manufacturing tends to produce a wheel which is in balance without lead. This is important since many wheels, especially for precision or semi-precision grinding are specified to contain no lead balance.

Working Test

Next, in order to be sure that the wheels are sound and not defective in structure, they are tested at a speed of 50% higher than the recommended operating speed, thus subjecting the wheel to a force 100% greater than that generated under normal working speed, thus providing a factor of safety of two. During this test the wheel is enclosed in a steel chamber to prevent injury to the operator in case of breakage. It is reasonable to assume that any wheel passing this test is free from structural defects and when properly mounted on a well made machine provides a safe working tool.

Before shipment the wheel goes to the final inspection department where it is again graded, measured and given a general examination.

With the remarkable improvement in the manufacture of grinding wheels and accompanied by that of grinding machines, their applications have grown tremendously. Their use varies from coarse snagging of castings to the finest precision grinding, although the latter applies more to vitrified and silicate wheels. The ideal wheel is one in which sharp cutting edges are continually exposed to the work, that is, the bond should hold the grain as long as it is sharp, allowing the grain to break away, exposing a fresh sharp surface as soon as this point has passed.

Successful grinding entails careful wheel selection and before the manufacturer can make the proper recommendations he must make a careful study of the job, including the kind of

(*Continued on page 453*)

Let's Start Advertising Now

By O. S. Tyson

President, O. S. Tyson & Co., Inc.

THERE has been a great deal of talk in the Plastics field during the past few years relative to "group effort." Some of this has been along the lines of pooling experience, some on searching out new fields, some on joint publicity — but, of course, the idea behind every suggestion has been the development of new and increased business.

The article "Molding Marketing Methods" by B. C. Budd in the July issue of "Plastics" is certainly very definite and to the point. It calls for action but does not point out just what that action should be or where it should start. It speaks of preparing a joint chart of materials and their performance, of promoting the business, of factors of success in distribution, etc., but does not say "let's start with this one thing first."

My association with the plastic industry reaches back about 20 years ago when Condensite and Bakelite were nibbling at publicity, Redmanol was not known—and, of course, the Bakelite combination not even in the air. Since that time, through my close association with industrial publicity, the entrance of many new concerns and products into the field has been watched with interest. I have had the opportunity of being associated with advertising programs on Bakelite, Lumarith and some others and through certain of my clients have been closely associated with the developments in using many other plastics in their products. This has even led to certain contacts with molders in New York State, New Jersey, Connecticut and elsewhere. In other words, as an advertising man, entirely outside the industry proper and not closely associated with any single concern in it, I have some background and knowledge of the field and its products—so, have certain ideas as to proper procedure for its development.

Mr. Tyson is President of an advertising organization specializing in class and industrial publicity and marketing. As Eastern Advertising Manager, he sold and wrote some of the original plastic advertising appearing in *Factory Magazine* almost a score of years back. Later, as Sales Manager of *Electrical World* he was intimately connected with the use and growth of plastics in the electrical field. His organization now directs the advertising of over 30 companies in the industrial field, many of which use plastics as a part of their products. His views as an outsider, but with a knowledge of our field and problems, should be of interest to our readers.

Why not start a joint publicity campaign on plastics as the initial step? This does not need much advance planning, does not require any policy changes by individual producers, does not call for delays to get group agreements on charting uses or performance. It is a step that can be taken immediately with a minimum of planning, that will help the entire industry, that will bring together producer and molder on a joint basis, that will have its effect on (and get cooperation from) present users, and that will influence prospective users of plastic products. Why not start this to the industrial and trade fields first (those who do and could use plastics in their products), then if successful, increase the campaign to influence the ultimate consumer of these products?

Many materials have already been advertised in such a way and with extremely definite and profitable results. The national candy, flower and paint campaigns we all know. The lumber, brick, cement and other similar group efforts have been successful business builders in trade and industrial fields.

The Nirosta Steel campaign which is illustrated herein was participated in by a small group at the start and within six months fifty-four producers and fabricators were associated together toward building more volume for this new steel.

The Underfloor Duct campaign, also illustrated, is running in certain architectural and trade publications at present. Here is an instance where no association, or other group tie-up was formed—merely a joint *advertising* effort. There is no headquarters office or other general signature on these advertisements, but each company has its own small individual panel. Every advertisement sells the "idea" but each "mentions" the individual manufacturer.

An example of co-operative advertising where no Association, headquarters, trade name or trade mark was established. The same ad runs in four publications but with a different "box". Each month the box is progressed so that each firm's name appears once every four months in each publication.

Payment for this campaign is divided into four equal parts.

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It would seem to me that a small group of those interested in promoting plastics should choose some outside organization and set them to work on developing such a publicity plan. The initial group should help, but not interfere. They should not insist on any "insider" doing the job, because one competitor is bound to look askance at any ideas or plans presented by some one associated with another competitor. They should forget, at least for the time being, all ideas of a strong "association"; who should be President; who should be on the Executive Committee, how much should each pay and on what basis. All this can come later, and will in all probability arrive naturally without bickerings, jealousies and such. It is surprising how competitors can get together in this country, and work together in a friendly fashion, *when they once see their mutual advantages.*

Advertising is a great tie that binds and a sure wedge to stronger cooperation. In some industries, good group advertising could not be done without an advance study of materials, products, uses, etc.; but the plastic

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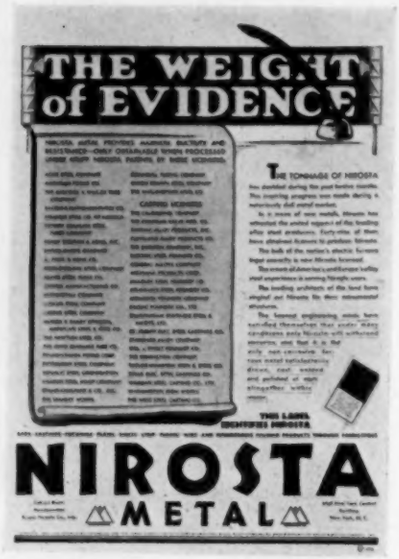
An example where a company (or Association) was formed, having headquarters, a trade mark and Exhibit Room. Payment for this campaign was assessed by proportion of the business done.



field already has thousands of examples, products, developments and features that are almost immediately at hand for proper use in proper advertising. More would flow in after the start and a sincere and honest publicity effort would soon bind the industry together and lead to some of those other steps that everyone admits are advisable.

Such an advertising campaign *might* be more helpful to one company than another—they frequently are, but usually only to those who are progressive enough to capitalize on the group effort. Usually, such a campaign steps-up all participants, creates more progressiveness throughout the entire industry—and thereby produces more business for all.

So why not a first step? Why not start some one working on an advertising plan? Why not an initial venture by the few who are in favor of an immediate start? The development expense would be small and all entering later could pro-rate this development cost as they came in. Others have done it. There are several tested plans for financing, operating and producing such campaigns.

The progressive ideas of many writers and speakers like Mr. Budd have helped pioneer for such action. The editorials of "Plastics" have helped clear the way. But hasn't the time now arrived for some one to start definite action?

Synthetic Resinoids In Dentistry

By Charles W. Rivise

THE article on the developments of this field, begun in the July issue of Plastics, page 415, is concluded with a compilation of some foreign patents in the art.

British Patent 1,269/1912. Teeth fillings are made of a condensation product of phenol and formaldehyde produced in the presence of natural resins, oils, waxes, balsams, tars or mixtures of them. The free acids of the alkali saponified products of these materials may be used, or in lieu thereof the condensation product itself may be saponified.

British Patent 2098/1913. See United State Patent 1,205,957 to Albrecht.

British Patent 110,154, Aug. 15, 1917. A product said to be useful in dentistry is made by heating eugenol or oil of cloves with formaldehyde. Variation is to pass formaldehyde into eugenol. Burnt alum may be added to the reaction mixture and zinc oxide may be added to the pasty product.

British Patent 238,446, Dec. *30, 1924.* The beading to represent the gum is modelled in wax on the otherwise finished artifical denture and invested therewith in a porous molding mass. The wax mass is then melted out, the water is removed, the hollow space in the mold is filled with Bakelite which has been thickened to a pasty consistency and the Bakelite is finally cured.

(*Continued on page 467*)

Synthetic Resin Finishes*

By Arthur J. Norton

Chemical Director, General Plastics, Inc.

PROBABLY at no time in the history of modern business has the appearance and finish of an article played so important a part in its merchandising as today, and probably no products aside from paints and varnishes themselves, have contributed so much to the appearance and finish of the products which are being manufactured in this modern day and age as the synthetic resins. Synthetic resins have contributed to finish in two ways. First, in the contribution of the thermosetting molding compound to industry and second in the contribution of a gum of superior qualities to serve as a base for the modern paint, varnish and lacquers.

The first of these products, that is the thermosetting resins, are the basis of the growth of an entirely new industry, the molding industry. Spectacular growth of new industries are not novel in this country but the rapid growth of the molding industry is novel in two ways. First, from the chemical standpoint is the large scale on which these complex products are manufactured with a very close degree of uniformity from an apparently violent and almost uncontrollable reaction.

Second is the wide diversity of industries in which these products find their use. There is scarcely an industry in the country today which does not use in some form or other the thermosetting resins or molding compounds, and a great many industries are becoming dependent on them.

By a thermosetting resin or compound is meant a product which will not only melt, flow and take the shape of the mold, but during the interval in which it is subjected to heat and pressure will set to an infusible, insoluble, lustrous completely finished article which may be taken from the hot mold without danger of warping or breaking. The chemical reaction which causes the setting of these products must be so complete during the short interval in which they are subjected to heat and pressure that no further change will take place after the product has been taken from the mold.

There are many varieties of thermosetting resins but very few of them will comply with this most important property. Any further change after the product has been taken from the mold causes checking, cracking, warpage and breakage and renders that particular compound useless for commercial production.

Historical

The history of these compounds is a very interesting one and parallels the history of the compounds which are now so important in the paint and varnish industry. In fact, the original work reported in the literature of phenolic resins was aimed to produce a product which would be a suitable substitute for shellac. The original work was reported in the literature about 1870 and in the period from 1900 to 1905 intensive work was done by European chemists in this field. None of the products produced by them in this period were of commercial value. However, a great many valuable contributions to the basic study of the formation of phenolic resins was made during this period and the names of Luft and Story stand out above the others in this work. Luft in particular, made a great contribution in applying heat to the molding process which at that time had been a cold molded art. In 1905 DeLaire in attempting to get better control of these very violent reactions isolated the first product of condensation of phenol and formaldehyde in the presence of an alkaline catalyst, that is the hydroxy-benzol alcohol. Starting with these comparatively pure products, he found that they could be condensed with a number of other products as aniline and nitrobenzol and a whole new series of resins could be formed. In 1906 Stephan took the phenol formaldehyde reaction with an alkaline catalyst in an autoclave and allowed it to progress to its violent end point. This gave him a product so inert, so completely infusible and insoluble as to attract considerable attention to the valuable properties this resin would have if it could be more carefully controlled.

In 1909 Baekeland took Stephan's process and by stopping the reaction earlier and applying Luft's ideas of hot molding, produced the first of the thermosetting molding products. Dent, seeing the possibilties of these products if they could be more closely controlled and produced at a more reasonable price, studied the reaction of DeLaire. He found that by DeLaire's method, close duplication from batch to batch

*Presented at the Plastics Symposium, 13th Chemical Industries Exposition, under the auspices of PLASTICS & MOLDED PRODUCTS, May 6 and 7, 1931.

was possible and that the product could be manufactured on a scale hitherto undreamed of. Foreseeing automatic or semi-automatic molding and large scale production he began the manufacture based on this process of modern Durez. From this time on, the progress of the industry was very rapid. The molding art became a molding industry and with products which were closely controlled and comparatively uniform large scale molding became a reality.

Molding on production basis is in keeping with the demands of the present day manufacturing and marketing methods. As our advertising department put it, Durez is the new age material because it meets production requirements and economies in manufacture, is beautiful in decorative schemes and provides something entirely different that will break sales resistance as in packaging, and its adaption to household articles as colorful knobs, handles, etc., for stoves and ranges, and this, of course, is the new age which they talk about—but I will not go into that new age thought of gigantic ocean liners propelled by rotors, electronic tubes and robots. That's the vision of the new age and it frightens even a chemist.

The original use of these compounds was in the electrical field but as they become more available and at a price competitive with wood, the uses began to be extended in a field where the extremely lustrous, durable finish of the product was the prime feature. Today, while the electrical industries are still very large consumers, a great deal of the product is going into modern industry with the one purpose of dressing up the final sales package of articles. A very good steering wheel can be made of rubber and most of the steering wheels are made of rubber, but in one molded of synthetic resins, the high lustre, the durable finish that does not rub off, even when the wheel is wet and the fine appearance of a molded wheel makes the demand for this type of product so great that it is overcoming even the cost difference between it and the cheaper rubber product of today.

In the packaging and closure field it is outstanding. Here it has completely revolutionized packaging methods. Starting with the old tin screw cap on the tooth paste tube, it has extended itself until there is scarcely a package of any drug or toilet article which is not topped off with a lustrous molded cap made from the modern thermosetting synthetic product.

The furniture field is rapidly investigating and adopting products of this type and there seems to be no limit to the uses to which these articles can be put and this whole industry is growing based on the fact that as the article comes from the mold without buffing, without polishing, without painting or without the finishing of any kind, it has not only the high lustre as reflected by the surface of the mold, but any engraving or design which may be placed on the mold. Articles can also be produced in close duplication to one another.

In Paints and Varnishes

The second field which these products have contributed to in the matter of finish is the paint, varnish and lacquer industry. While all the original work was done with an aim to producing a synthetic phenolic product which could be used in this industry none of the ordinary condensation products were satisfactory. As phenol and formaldehyde combine under ordinary conditions, they become progressively less and less soluble until they reach the final set up where they can not be dissolved in any common solvent. This of course, renders them useless to the paint or varnish field.

Albert in Germany finally hit upon the scheme of fluxing these insoluble resins with natural resins, such as rosin or some of the synthetic gums, such as ester gum in order to render them dispersible in oils and other paint vehicles. For a great many years his work did not produce any striking results. However, on the introduction of the gums to this country, it was found that ordinary varnishes which required 12 to 14 hours to dry could be made to dry in 4 to 6 hours. This find was a remarkable thing for the varnish trade because the quick drying lacquers had almost displaced varnishes in a great many fields where they had formerly been used. The history of the development of the quick drying enamels is known to all. However, all through the work there was a cry for an all synthetic gum. A gum which is truly soluble in oil and not just dispersed by means of fluxes—and it is only recently after the whole development of the molding industry that manufacturers of phenol formaldehyde resin have been able to supply this demand of the paint and varnish trade. Now the availability of an all phenolic resin such as the Durez 500 Resin, which is truly soluble in oil of all types and is compatible with the nitrocellulose in the lacquer fields and is soluble in most of the common lacquer solvents, makes available to the paint and varnish trade, the durable, lustrous high finishes which could be obtained only through the molding of the synthetic thermosetting compounds before. The all phenolic gum gives great flexibility of formulation. It can be used straight to produce tremendously resistant film to alcohol, alkalies and other common solvents which destroy the ordinary varnish and lacquer film so rapidly, or can be reduced with other gums of varying natures. It can be reduced with any gum which the varnish manufacturer desires to use. He is not confined to the rosin or ester gum which are used as common fluxes in the ordinary resin.

In the insulating field the electrical properties of the phenol formaldehyde resins are

transferred to the varnishes. In the other fields the high lustre and the extreme durability of the finish, which incidentally is available in no greatly increased cost, bids to revolutionize the public conception of paints, varnishes and lacquers.

In this outline no mention has been made of resins, other than the phenolic product. There are thousands of other types of resins. In the thermosetting field however, practically no other product has reached conspicuous volume except the phenol formaldehyde types for the reason that few other products if any, are completely thermosetting in the short space of time which is demanded by the modern molder. The urea resins have reached some degree of volume but primarily in the novelty trade. In the paint and varnish field there is a greater variety of synthetic resins. There are of course, the esters of the common resins such as ester gum and then the glyptols — phthalic anhydride glycerine resins—and the rezyls, that is mixtures of resins with the urea products, but in all these fields the outstanding resin is the phenolic resin and the outstanding feature of the phenolic resins is a high lustre, a quick action and availability of the product made from it and the durability of the final article. It is doubtful if any one industry has contributed more spectacularly to the advance of modern manufacture than the phenolic resin industry and from a chemical standpoint the control and manufacture of these resins directing their course to the field for which they are being made is an outstanding achievement. To think that these difficultly controlled violent products have been made available in carload lots at a price which makes them competitive with wood or any other building materials and common gums of natural origin when ten years ago their price was so prohibitive, their manufacture so difficult, that they were available only to those industries where their peculiar properties made them almost a necessity, brings emphatically to the foreground the dependence of modern industry on chemical research.

Bakelite Laminated Improves the Bosch Trimming Board

STERLING arguments are advanced for the adoption of Bakelite laminated sheet stock for the surface of the Bosch Trimming Board, manufactured by the Bosch Products Company of New York. To begin with, the appearance of this trimming board is undoubtedly enhanced by the glossy black resinoid, which offers a fitting background for the white quadratic lines and graduated scale on its surface.

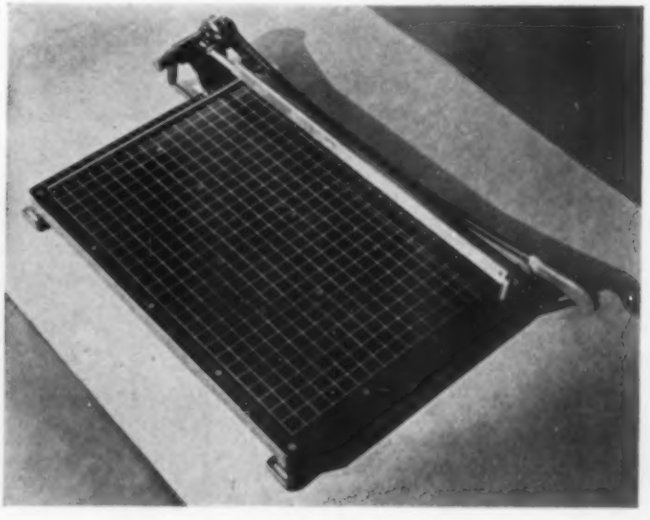
Speedier

Second, the use of Bakelite laminated material makes possible more speedy operation of the trimmer. Photograph prints blue prints, photostats, news clippings — the multitude of things which need to be trimmed—slide more readily on the resinoid than on wood or metal. This increases the speed of the cutting operation as the expert trimmer does not lift the print that he is cutting, but rotates it on the board. Moveover, there is considerable static in prints fresh from the drier which causes them to cling to the surface on which they are first placed. This annoyance is reduced to a minimum by the use of phenol resinoid.

Atmosphere Resistant

Other advantages are the freedom of the Bakelite laminated material from effects of atmospheric changes, an important point in the construction of a long-lived precision tool; lightness in weight for a given strength, an important factor in designing a portable device; and the qualities of ease of fabrication and durability.

From the operator's viewpoint, the new design of the Bosch Trimming Board also presents a most desirable feature. An automatic hold-down clamp has been added which works through the movement of the upper knife, in advance of the shearing. Under compression, a print is firmly held to the cutting edge for its full length before shearing begins, preventing any movement of the print, and securing perfect alignment. Those familiar with the old method of holding print or paper in place with the fingers will appreciate the full value of this new device which combines safety with speed and accuracy.



Sakaloid—A New Sugar Plastic

The inventor describes its properties especially for Plastics and Molded Products

By Arthur S. Ford

SAKALOID is the newest comer in the field of resins and promises to find a wide use in the arts and in the realm of plastics.

Sakaloid, as its name implies, is a condensation product of sugar, dextrose, levulose, cane and beet varieties and molasses and even sugar cane itself.

Among the many distinguishing characteristics of Sakaloid is its absolute water white clarity. A block of Sakaloid ten or more inches thick can be placed over the smallest type and the latter can be read through the mass as well as if uncovered.

Sakaloid, when first prepared, is a thick, highly viscous, elastic mass and this can be placed in solution for lacquers and varnishes, can be poured into molds to set, can be die cast or can be processed further into elastic rubbery plates, sheets or rods, all of which take a brilliant polish and have all the appearance of the clearest quartz or glass. *Rubba-Glas* is the name given to this stage of the product and it is in effect a glass which can be cut, sliced or machined with ease It is tough, elastic, and can be bent or twisted like so much rubber. This stage is controllable and can be rendered permanent by variations in manufacture so that the product remains permanently flexible and resilient. Its clarity permits the widest lattitude of color, a drop of concentrated dye in the mix resulting in a perfectly distributed tint.

The next stage of Sakaloid is the hardened form and when this is carried through we have the final brilliantly clear quartz-like product. This is an ideal lens and optical material with a refractive index approaching quartz, a transparency to ultra violet and infra red rays and with it all a material that can be drawn, machined or drilled in any manner.

From this end material the molding powder is made and this powder when hot pressed flows and forms like plastics of the familiar type but the molded piece is as transparent and clear as glass. Once this has been done the material ceases to be thermoplastic, heat serving only to harden the material further.

Sakaloid in all its forms is absolutely unburnable. It gives off no gases on exposure to flame. It does not melt; even will not support a flame but simply chars when the heat of the flame grows too intense. For X-ray and photographic films of all kinds, Sakaloid offers many practical advantages besides being unique in its use for molded cases and boxes where complete visibility of the contents is desired.

Sakaloid can be sheeted for protective package purposes in any degree of thinness or thickness without losing its perfect clarity and of course it can be applied to paper or textiles for a host of purposes.

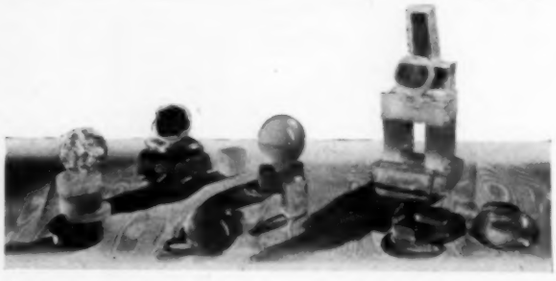
Sak-a-tex is the name given to this branch of manufacture and a wide use in this line is indicated. *Sak-a-lac* is the type material designed for varnishes and lacquers. Sak-a-tine is the name for the material when extruded into filaments for spinning and weaving as an artificial silk.

Space forbids any elaboration of detail in this article but I have given an outline of the leading characteristics of Sakaloid and as preparations are being made to enter the various markets readers will soon have an opportunity to see this new interesting product in actual use.

Sakaloid is a polymerised sugar product and takes this "Cinderella" of the chemical world and opens up new fields for its use when they are badly needed.

Its manufacture is simple and economical and with such a low priced initial product its final cost is naturally low.

I have given nearly ten years to the development of Sakaloid, my first piece having been produced in 1892. There is naturally much to do in the adaptation of the material to many new commercial uses but I can confidently leave those problems to the many bright minds in the plastic industry whose cooperation is already proving helpful in the highest degree.



Samples of Sakaloid, the new sugar plastics, shown in various forms. Included are the elastic, rubbery masses, completely hardened forms, some tinted and others water white, some molded from powder and some cast.

GONCENTRATION

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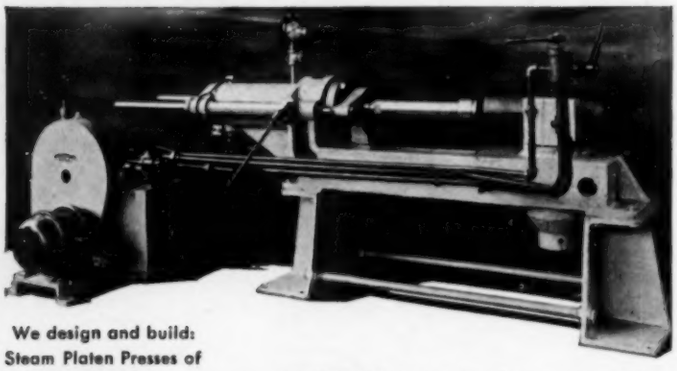

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Everybody Uses Toothbrushes

But the Tefra Refillable with the Molded Lumarith handle is one set apart with a host of different features

CONSIDER the toothbrush . . . your toothbrush, your neighbor's toothbrush — anybody's toothbrush.

Not so long ago a toothbrush was just a toothbrush—a very necessary article and no home was complete without at least one for every member of the family—but there it was. Just a toothbrush.

All this was before Style and Color Harmony hit the American bathroom. Tin bathtubs were still the rage and white was the prevailing color scheme—white for cleanliness. Suddenly the bathroom was set upon by an army of Stylists and people made a great discovery. They found, first of all, that "white" had no monopoly on cleanliness. Black, blue, green, gold, pink—any color or color combination in good taste—could be just as clean as white. They also found that the introduction of color made the bathroom a much more charming room and it gave the home decorator much more latitude in selecting matching fittings such as shower curtains, fixtures, bath mats, towels, lights, hampers . . . .

And toothbrushes.

The plastics industry took over toothbrushes, color and style overtook toothbrushes, and "the old family toothbrush" became a nationally advertised item, with full, four-color pages in the magazines, slogans, and everything. Color was stressed as was the style of the handle and the angle of the bristles. This type was good because it got around the corners, and that type was unexcelled because it did double duty by also massaging the gums. And, in case one's mind might wander from the ever-important matter of the care of the teeth, a barrage of closely related advertising quickly brought it back to the subject again. From all quarters that met the eye and ear were flashed and re-flashed the virtues of various brands and kinds of dentifrices, mouthwashes, etc.

The toothbrush had come into its own.

The value of a plastic material like Lumarith in the manufacture of toothbrushes can easily be understood in the light of the development sketched above. With color a dominant factor, the unlimited color range possible with Lumarith molding material makes it ideal for this purpose. Now, whatever the color scheme of the individual bathroom, there is an exact or harmonizing colored brush made possible with Lumarith. From the angle of style of handle, the easy moldability of Lumarith makes possible any style desired with a minimum production cost.

In this connection, the experience of the developers of an entirely new idea in toothbrushes is interesting. By now, the whole country is familiar with the Tefra refillable toothbrush. The handle is molded with an open, socket-like head, into which the part holding the bristles is slipped. This latter part can be removed and a new one put in when the bristles wear out. As the Barbasol Company, makers of the Tefra brush, say in their advertising, Tefra is the greatest thing "since the invention of the safety razor." Just how and why Lumarith was adopted for the manufacture of this brush is best told in the words of the Barbasol Company in a recent letter to the Celluloid Corporation:

"Of course, the reason for the Tefra brush is fairly obvious; particularly to anyone familiar with toothbrush costs. It is, of course, ridiculous to buy a new handle, representing more than half the cost of the entire brush, each time a new brush is needed. The obvious answer to such a situation was the Tefra refillable toothbrush which makes it possible to renew the brush by replacing the bristles at a very nominal expense. Moreover, there is a growing tendency to use a new brush every thirty days on the advice of the better dentists, for new, fresh, springy bristles clean the teeth much more efficiently.

"The design of the handle was simple, but to find a suitable material capable of quantity production was not so easy. The Tefra Company experimented with many different materials and adopted Lumarith because it was superior to anything else tried. It had the required strength and elasticity necessary to hold the refill. It was available in a wide variety of beautiful colors, which is important since the permanent handle is retained and consequently an attractive appearance was highly desirable.

"Most important of all, Lumarith is capable of being molded very accurately, and in fairly abrupt changes of section, enabling us to obtain a Tefra handle, with the very necessary accurate socket size, direct from the mold without further operations or machining. We know of no other material which possesses the strength and elasticity combined with extraordinary beauty and at the same time capable of being accurately molded as Lumarith."

Electrical Insulation and Synthetic Resins

By A. Morris Thomas

ELECTRICAL engineers and manufacturers of electrical insulation, as well as chemists engaged in the synthetic resin industry, showed great interest in a paper* read at the recent Annual General Meeting of the Oil and Chemists Association in London.

The authors attempt to deal with a comparatively unexplored region which nevertheless is of great importance for the future development of the electrical engineering industry. The first part of their paper concerns the chemical aspects of the problem of electrical insulation. From a chemical point of view insulating materials may be classified under two headings, namely, "true" dielectrics and "pseudo" dielectrics. The former are homogeneous substances, elements or compounds which do not form ions and do not possess true electrons. Only certain elements of low atomic number such as hydrogen, carbon, oxygen or sulphur are able to form true dielectrics, and it will be noted that these are the elements of which in general all organic substances, including synthetic resins, are formed. Pseudo-dielectrics on the other hand are non-metallic substances which, although capable of ionization do not conduct electricity, under ordinary conditions, owing to the high internal resistance offered to the motion of their ions. Practically all industrial solid and liquid insulation if of this class; commercial insulating materials of an organic nature though composed in the main of true dielectrics elements contain ionic impurities. A colloidal structure is inimical to ionization and true insulating materials are frequently found to be colloids.

*"Electrical insulation with special reference to the application of Synthetic Resins", by W. D. Owen and A. Morris Thomas (of the British Electrical and Allied Industries Research Association).

The authors then point out that the formation of synthetic resins by condensation and polymerization is apparently just such a process as is required to produce good insulating materials, since the basic substances are true dielectrics which may be obtained in a high state of purity and no admixture with substances of an ionic nature need occur except in so far as a catalyst is necessary. With improved methods for obtaining greater purity and avoidance or neutralization of any ionic satalyst, considerable improvement in synthetic resin insulating materials should result. A brief survey of the synthetic resins used in the electrical industry is also given, Phenol-formaldehyde resins receiving special notice since these predominate. The purity and supply of raw materials is of fundamental importance and some information on this point is included. With regard to phenol, any future expansion of demand is likely to be satisfied by the manufacturers of synthetic phenol. Supplies of natural phenol obtained from coal tar are not expected to be affected by the development of low temperature carbonization.

Prediction of Properties

Prediction of properties of synthetic resins from the known chemical constitution of the primary substances would be of great value and certain suggestions of R. H. Kienle to this effect are referred to.

It appears that in a number of cases the physical properties of the final product depend on the number and position of the primary valencies possessed by the molecules of the initial products.

The authors then proceed to discuss the characteristic properties of electrical insulation, particular mention being made of recent theories with regard to the electrical properties.

Volume and surface resistivity are greatly influenced by atmospheric conditions and therefore careful conditioning is necessary before tests are made. Permittivity, the term now used generally instead of the older specific inductive capacity is important, when as is often the case, different dielectrics are placed in series in an electric field. Power factor is of fundamental importance, and as low a power factor as possible is always to be desired for electrical insulating material. The electric strength is also of the highest importance. The breakdown of insulation may be caused by different processes but industrial breakdowns are generally of thermal nature due to the increase of power factor and dielectric loss with temperature. Frequently also breakdown is caused by discharges in the ambient medium (air) due to high stresses at the corners of conductors and insulation.

Industrial synthetic resin products for electrical insulating purposes are marketed in the following forms, moulded products, laminated paper products, impregnating varnishes, cements and oil soluble varnish resins.

The British Electrical and Allied Industries Research Association have published a large number of reports dealing with methods of test and insulation problems, a complete list of these reports being given.

THE Roessler & Hasslacher Chemical Co., Inc. have removed their principal sales offices which are now located in the Empire State Building, 350 Fifth Avenue, New York City.

MR. Edward Raymond, formerly sales manager, and Mr. Samuel Chameides, formerly chemist of the Lustrite Corporation, are now affiliated with the Marallen Products Company, Brooklyn, N. Y., manufacturers of toilet preparations.

Resinoid Grinding Wheels

(*Continued from page 442*)

material to be ground, the type of grinding machine and speed, and amount of material to be ground. The higher the operating speed of a wheel the harder will be its effective grade, so for the same job a harder wheel should be used on a low speed machine, other conditions being the same. As a wheel wears down, it must be operated at a higher R. P. M. in order to maintain its surface speed. Pressing with a higher density on the inside tends to compensate somewhat for loss of speed. Fast cutting is obtained by a coarse wheel whereas for finish a fine wheel must be used. Sometimes a long series of grit numbers is used to combine the rapid cutting of the coarse grain with the finer finish of the finer grain. A wheel may contain both silicon carbide and aluminous abrasive to combine the free cutting action of the former with the toughness of the latter, hence increasing wheel life.

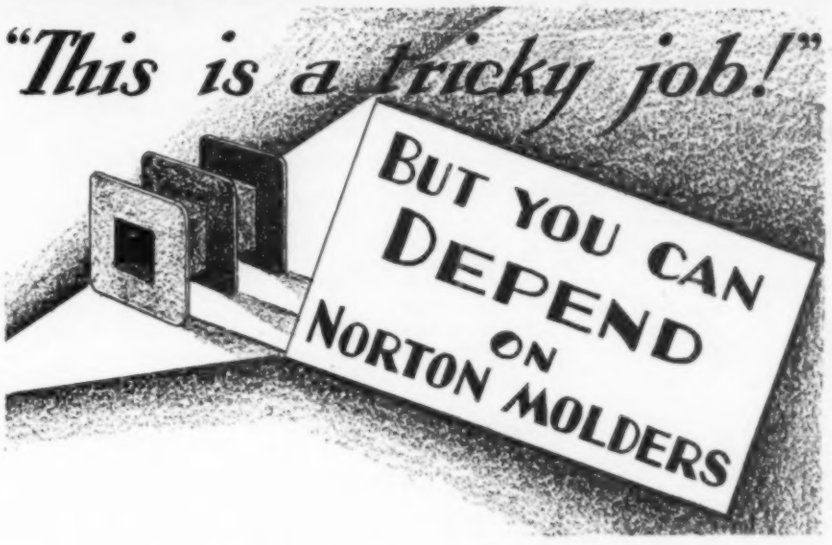
A real engineering study of the operation having been made, a series of trial wheels are submitted and from these the best wheel is selected.

Although the percentage of resin contained in grinding wheels is not large, generally a maximum of ten percent in large wheels and eighteen percent in cutoff wheels, the annual consumption is many thousand pounds, which is a sizeable proportion of the phenol aldehyde resins produced.

The author is indebted to "Artificial Abrasives and Manufactured Abrasive Products and Their Uses" (V. L. Eardley Wilmot) for historical references and certain statistics.

Hercules Nets $736,103 First Six Months

NET profits of $736,103 are shown by Hercules Powder Company for the first six months of 1931. After payment of preferred dividends, this is equivalent to 55 cents per share on the 606,234 shares of no par common stock of which 52 cents per share was earned in the second quarter, and 3 cents per share was earned in the first quarter.



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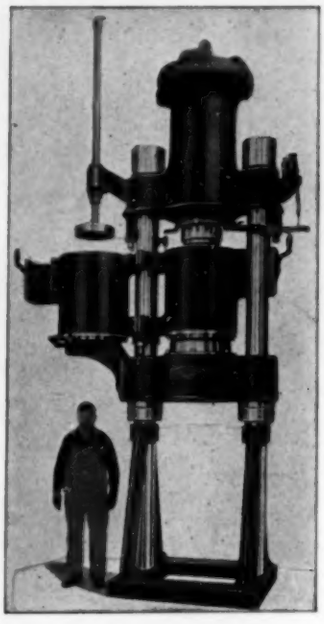

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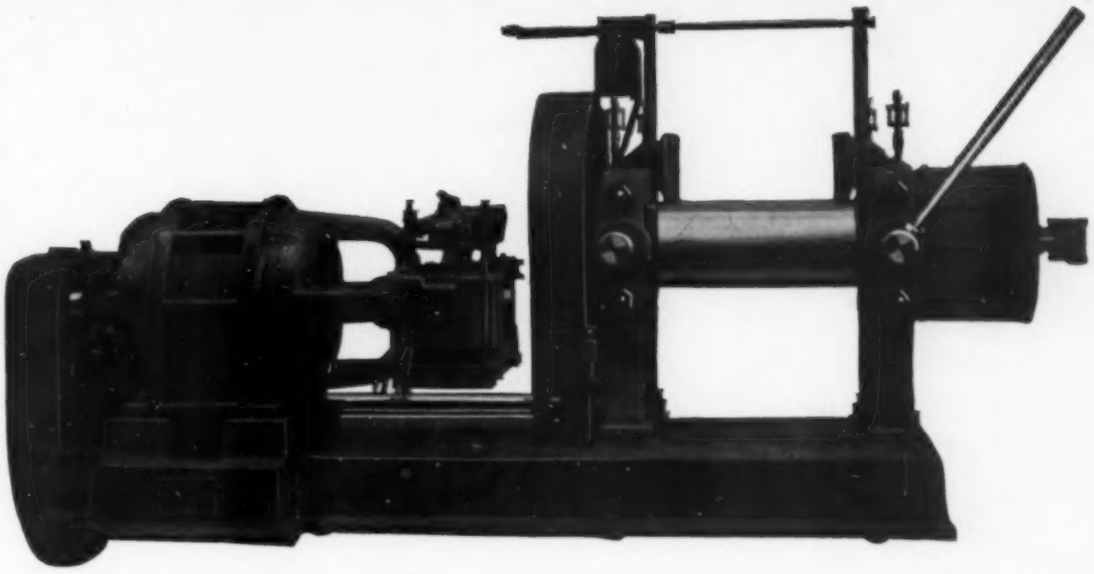

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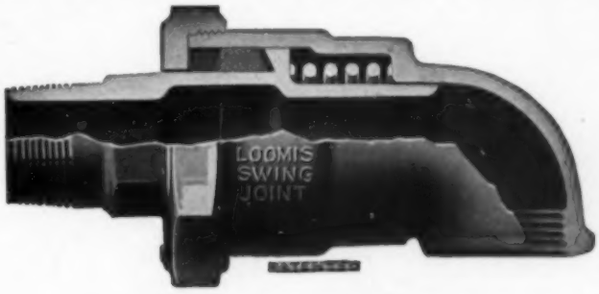

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Urea Resins for the Molding Industry*

By Charles E. Slaughter

Unyte Corporation

IT has been known since the beginning of the century that urea and formaldehyde can be reacted together to produce a wide range of products quite dissimilar to the original materials, but it has only been during the last few years that these condensation products have come within the range of commercial molding. This change has been brought about chiefly by the manufacture of urea by synthesis from nitrogen of the air, a process that has been developed and brought to a high state of perfection by the I. G. Farbenindustrie A. G. of Germany.

The result of this new process has brought about a drastic reduction in prices, so much so that in 1925, the price of technical quality urea was approximately 10 times what it is today. The synthetic manufacture of methanol under high pressure and its subsequent conversion to formaldehyde has also wrought a great change in the price structure of this important raw material.

The urea-formaldehyde condensation product is a transparent, water-white product, somewhat similar to glass in appearance. It is colorless, light-stable and will transmit about 90% ultra-violet light. The pure resin can, however, only be molded with difficulty and the molded product lacks strength, but it has been found that the addition of a fibrous filler such as cellulose increases the strength by several hundred per cent. Curiously enough, the addition of this opaque material does not cause the finished molded product to become opaque. While the combination of filler and resin is no longer transparent, it still retains a high degree of translucency, and since the original resin is water white, the addition of dyes or pigments permits the fine coloring and shading effects that are already becoming known to the public.

Until quite recently the urea formaldehyde molded products were not particularly resistant to water, and it was found necessary to replace part of the urea with a sulphur compound of urea, namely Thio-urea. This resin produces a very satisfactory commercial product. Unfortunately, however, the sulphur attacks the steel of the molding dies with disastrous results. When using urea-thio-urea resins it is therefore necessary to use either stainless steel or chromium-plated dies. The latter, owing to their hardness, have been found to be more durable in mass production work.

Recent progress in the manufacture of urea formaldehyde resins has brought to light still another type of product which has excellent water resistant properties, without the aid of thio-urea. This new product does not require stainless steel dies and it is also cheaper, with the result that the scope of its uses is greatly increased.

At the present time there are a number of small articles of urea and thio-urea molded products on the market, including quite beautiful cups and saucers, clock cases, tumblers, etc., but wider plans are afoot. One European concern is already turning out one-piece molded radio cabinets in cream and soft pastel shades, also table tops in plain and mixed colors, some of which imitate the finest marble.

This, however, is likely to be only the beginning for in the future we may expect wall panels and furniture for the office and restaurant. We may also expect complete automobile bodies built up of beautiful molded panels. Such bodies would be strong and light, they could be polished with ease and would never need re-painting.

The urea formaldehyde resins have so many desirable qualities, for not only are they obtainable in every shade of color, translucent and opaque, but they are also strong, odorless and non-inflammable. So, with a little imagination, not only the molder but the man in the street can realize the great possibilities of this comparative newcomer to the field of plastics.

*Presented at the Plastics Symposium, 13th Chemical Industries Exposition, under the auspices of PLASTICS & MOLDED PRODUCTS, May 6 and 7, 1931.

The New, Improved Durez

PRODUCTION of new Durez blacks and browns, vastly improved, but selling for the same price and under the same code numbers as the compounds they supercede, was started recently by General Plastics, Inc. N. Tonawanda, N. Y., according to A. J. Norton, Chemical Director of the Durez laboratories. No public announcement of the new compounds has hitherto been made.

The improvements reported in the new materials (coded as 2260 black and 1438 brown) are as follows: A much better finish,—smoother and more lustrous; greater structural strength; greater resistance to moisture and chemicals; higher dielectric strength; greater flow and plasticity, (that is, softer

(*Continued on page 473*)

Technology of Cellulose Acetate

Progress in the Preparation of this Cellulose Ester as Shown in the World's Patent Literature during the last Decade

By Dr. Aladin

Continuing this concise but comprehensive review of the world's patents on Cellulose Acetate which issued during the past decade, we now come to those patents which particularly relate to the

II. E. Pretreatment with Various Substances

Serial No.	Patent No.	Patentee	Title	Brief of Description
81.	U. S. P. 1,681,103	C. Diamond (Courtaulds, Ltd.)	Preparation of cellulose acetate.	Cotton or cellulose is treated either at ordinary or elevated temperatures, with a phenol. Excess phenol is subsequently removed by means of a centrifuge.
82.	B. P. 269,012	(Courtaulds, Ltd.)	Preparation of cellulose acetate.	See U. S. P. 1,681,103 (No. 81.)
83.	B. P. 293,757	I. G. Farbenindustrie A.-G.	Preparation of carbohydrate esters.	The air content of cellulose or starch, which prevents the rapid wetting thereof, is removed by treating the substances, preferably in a vacuum, with gases or vapors of substances soluble in acetylating baths, such as pyridine, ammonia, acetic acid, formaldehyde, steam, etc. Example:—moist cellulose is dried under vacuum in the presence of ammonia gas; and is then acetylated.
84.	F. P. 632,636	(Courtaulds, Ltd.)	Preparation of cellulose acetate.	See U. S. P. 1,681,103 (No. 80.)

III. Catalysts

85.	U. S. P. 1,389,250	J. Koetschet and M. Beudet (Societe chimique des Usines du Rhone)	Preparation of cellulose esters.	A chloroform-insoluble cellulose acetate is obtained when cellulose is treated at 0°-30°C. with acetic acid containing sulfuric acid, which former also contains from 1-20% of acetic anhydride.
86.	U. S. P. 1,445,382	J. O. Zdanovich	Preparation of cellulose acetate.	Cellulose is first treated with about one-half of the required amount of acetate anhydride or acetyl chloride, being heated to 40-100° C; whereafter the balance of the acetic anhydride is added and the mixture cooled. Then sulfuric acid, chlorosulfonic acid or phosphoric acid is added to serve as a condensing agent, which causes the cellulose to pass into solution.
87.	U. S. P. 1,457,131	J. O. Zdanovich	Preparation of cellulose acetate.	Into a mixture of cellulose, glacial acetic acid and acetic anhydride warmed to 40-50° C, chlorine is passed until the fiber has disintegrated. The mixture is then cooled to 15-18° C. and small amounts of a solution of sulfuric acid in acetic or formic acid are added. The cellulose soon after dissolves.
88.	U. S. P. 1,466,329	H. P. Bassett	Preparation of cellulose acetate.	Cellulose is acetylated with acetic anhydride in presence of a coal-tar distillation product such as benzene, using sulfuric acid as a catalyst. The cellulose acetate, which remains insoluble, is filtered from the mixture. The filtrate is distilled to remove the benzene. The residue of this distillation is mixed with sulfur chloride and treated with chlorine, to yield acetyl chloride, which in turn is converted into acetic anhydride by means of sodium acetate.

Serial No.	Patent No.	Patentee	Title	Brief of Description
89.	U. S. P. 1,528,810	J. O. Zdanovich	Preparation of cellulose acetate.	Cellulose is immersed in the usual acetylating mixture, whereupon chlorine is passed into the same until the cellulose has disintegrated; then surfuric acid is added, which causes the cellulose to dissolve. Formaldehyde is then added.
90.	U. S. P. 1,591,590	Eastman Kodak Co. (W. R. Webb and C. J. Malm)	Preparation of cellulose acetate.	Cellulose is placed in a mixture of glacial acetic acid and acetic anhydride, red phosphorus is added, and then chlorine is passed into the mixture at 60° C. as long as it continues to be absorbed.
91.	U. S. P. 1,645,915	Eastman Kodak Co. (C. J. Malm)	Preparation of cellulose esters of organic acids.	Perchlorates of metals other than those of the alkalies are used as catalysts; such, for example, as aluminum, manganese, copper, zinc, ammonium, magnesium, calcium, barium, lead, methylamine, quinoline, and pyridine. The acetation is carried out throughout at from 60-65° C.
92.	U. S. P. 1,652,024	Apex British Artificial Silk, Ltd. (L. A. Levy)	Preparation of cellulose acetate.	A chloroform-soluble cellulose acetate is obtained by treating air-dry cellulose containing from 6-7% of water with a mixture of acetic acid and acetic anhydride in the presence of chromium salts.
93.	U. S. P. 1,655,870	L. A. Levy	Preparation of acetone soluble cellulose acetate.	One or more salts of metals such as nickel, cobalt, vanadium or chromium are added to the usual acetating bath to enhance the efficiency of the surfuric acid therein contained. Example: Use of chromium acetate and a working temperature of 15° C. until all the cellulose has dissolved, whereupon the mixture is heated until a sample precipitated from the mixture proves to be soluble in acetone.
94.	U. S. P. 1,690,632	Eastman Kodak Co. (H. L. B. Gray and C. J. Staud)	Preparation of chloroform-soluble cellulose acetate	Either cellulose (as cotton) or incompletely acetated cellulose is placed into acetic anhydride which contains a catalyst consisting, for example, of equal parts of sulfuric and phosphoric acid. The cotton is then squeezed out until the original 100 parts by weight of the same weigh 320 parts. The resultant wet mass is then stored in a closed vessel at room temperature until the acetation has completed itself.
95.	U. S. P. 1,701,229	Ch. Ebert and Th. Becker (I. G. Farbenindustrie A.-G.)	Preparation of Cellulose esters.	Cellulose or its immediate derivatives is treated with glacial acetic acid and an organic acid anhydride, using as catalysts such substances as halogenides of sulfurous acid (as thionyl chloride) and a heavy metal salt as zinc chloride or copper chloride. The primary acetates are converted into acetone-soluble products by means of water that is added to the acetating mixture.
96.	U. S. P. 1,711,314	W. Gruber (Dr. A. Wacker Ges. f. elektrochemische Industrie)	Preparation of cellulose acetate.	Cellulose is acetated, using zinc chloride as a catalyst, and working first at a temperature of 55-60° C. and later at 40° C. The product, which is soluble in chloroform, has a high viscosity and good mechanical properties.
97.	Can. P. 259,328	L. A. Levy	Preparation of acetone soluble cellulose acetate.	See U. S. P. 1,655,870 (No. 93.)
98.	Ger. P. 488,528	Dr. A. Wacker Ges. f. elektrochemische Industrie (W. Gruber)	Preparation of chloroform-soluble cellulose acetate.	See U. S. P. 1,711,314 (No. 96.)

Serial No.	Patent No.	Patentee	Title	Brief of Description
99.	B. P. 240,624	L. A. Levy	Preparation of acetone soluble cellulose acetate.	See U. S. P. 1,655,870 (No. 93.)
100.	B. P. 265,267	L. A. Levy and O. Silberrad	Preparation of cellulose acetate.	See U. S. P. 1,652,024 (No. 92.)
101.	B. P. 282,793	Ruth-Aldo Co. Inc. (H. L. Barthelemy)	Preparation of cellulose esters.	Cellulose is treated with acetylating mixtures, which, besides sulfuric acid as a catalyst, contain a substance which has a mild oxidizing action on cellulose, such as manganese sulfate or acetate, chromic acid, monopersulfonic acid, manganic or permanganic acid, peracetic acid, etc.
102.	B. P. 289,973	I. G. Farbenindustrie A.-G.	Preparation of cellulose esters.	See U. S. P. 1,701,229 (No. 95.)
103.	B. P. 291,001	Dr. A. Wacker, Ges. f. elektrochemische Industrie	Preparation of cellulose acetate.	See U. S. P. 1,711,314 (No. 96.)

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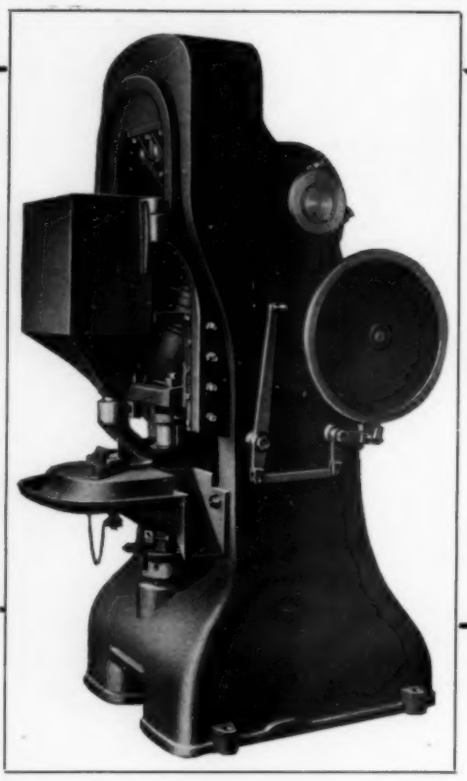

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Serial No.	Patent No.	Patentee	Title	Brief of Description
104.	B. P. 291,360	I. G. Farbenindustrie A.-G.	Preparation of cellulose esters.	Cellulose is treated in presence of an organic base, such as pyridine, and an indifferent organic diluent such as aromatic halogenated hydrocarbons, as chlorobenzene, with an halogenide of a lower fatty acid; for example acetyl chloride.
105.	B. P. 293,724	Noninflammable Film Co. (H. J. Malabor)	Preparation of cellulose acetate.	Cellulose is acetylated with zinc chloride as a catalyst, hydrochloric acid being also added. The acetation can thus be carried out cold, thus avoiding undesired depolymerization of the cellulose. The transformation into the acetone-soluble variety is effected by addition of definite amounts of water or by treating the precipitated product with a dilute mineral acid.

(To be continued in September)

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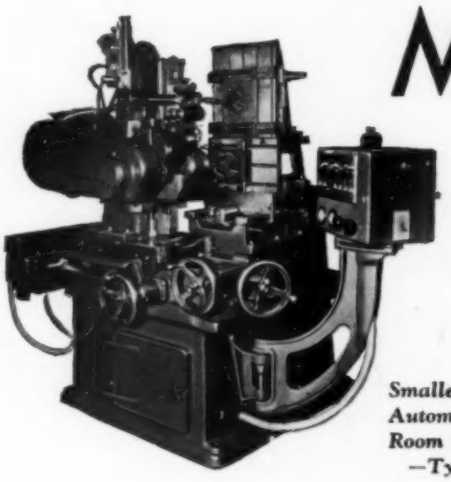

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Iwan Ostromislensky

It is not often that an inventor divulges some of the details of his research work and describes the products made by various modifications of a process. Not much has been published on the resins resulting from the polymerization of vinyl esters.

The article is taken practically word for word from the author's U. S. P. 1,791,-009; February 3, 1931. This invention relates to processes for obtaining soluble modifications of polymerized vinyl chloride or caoupren chloride, more particularly the beta modification.

WHEN the vinyl chloride is subjected to the action of light, polymerization commences, the alpha modification being first formed. Later the alpha modification, or a portion thereof, is converted into the beta, and if the process is continued, the delta and gamma modifications are formed, the alpha and beta modifications, or a portion thereof being converted into the delta and gamma modifications.

The delta and gamma modifications are not suitable for some purposes the product is designed to serve, nor is the alpha modification as suitable as the beta for the manufacture of said products, such for instance as film supports, wherein the support must have durable flexibility and elasticity. Supports made from the alpha modification tend toward brittleness, and from a mixture of the modifications the product is brittle, lacks transparency, and gives a wavy surface.

Checking Polymerization

Since in polymerization the tendency of the product is to pass progressively from the alpha to the beta, to the delta, to the gamma modification, it is obvious that if the polymerization is checked at the proper time, the polymers formed will be wholly of the soluble modifications. The alpha modification first formed and which has not been converted into beta may be removed by dissolving it in acetone. Since the beta modification is insoluble in acetone, it remains in the solution and may be recovered by dissolving it in chlorbenzol.

If the process be interrupted before the formation of the delta modification commences, the unchanged portion of the vinyl chloride may be evaporated, leaving the polymers which may be separated and isolated as above described. While the velocity of the polymerization depends on the nature of the light rays, the change from beta to delta and gamma may be hindered by the addition of a suitable solvent, that is by treating the vinyl chloride in a solution with the light. Suitable solvents are ether, ethyl or methylalcohol, symmetrical tetra chlorethane or chlorbenzol, and the like.

Since the delta and gamma modifications are insoluble in chlorbenzol, it provides a convenient index for determining when the conversion from beta to delta and gamma commences. That is when the forming polymers cease to be soluble in chlorbenzol, alpha and gamma polymers are forming, and if the process is interrupted at this moment, the product will be composed substantially wholly of alpha and beta modifications.

Another method of obtaining wholly chlorobenzol soluble modifications, is by treating the vinyl chloride in solution. The most soluble alpha modification seems to be in a condition of the highest chemical stability when preserved in ether. Therefore, ether is a preferred solvent for the vinyl chloride, insuring speedy and reliable production of the soluble modifications when polymerized in this solution.

Alcohols may also be used as solvents, as for instance, methyl alcohol, but the alpha modification obtained in this manner tends to change readily into the beta modification, and to assume a yellowish color, which for many purposes is objectionable. The solvents may be removed by evaporation.

Impurities as Catalysts

Quite often the soluble modifications obtained by polymerization are converted into one of the insoluble modifications, gamma or delta at the moment when the soluble modification is separated from the mixture undergoing polymerization. This is true in the polymerization of free vinyl chloride, as well as of solution. However, the transformation at the point of isolation occurs only when the original vinyl chloride was not sufficiently pure, that is, when it contained admixtures, as for instance of various chlorides. which acting as catalysts tend

to accelerate the successive transformation from alpha to beta to delta to gamma.

This conversion at the moment of separation may be prevented or inhibited by introducing into the mixture under reaction, before evaporation of the unchanged vinyl chloride, a solvent, such as chlorbenzol, tetrachloroethane, ether, ethyl or methyl alcohol, or the like. These substances not only preserve the soluble modifications in their soluble form, but as well remove the impurities above mentioned, such as chlorides which act as catalysts by solution.

The beta modification may also be obtained by conversion of the insoluble delta modification. The delta modification may be obtained by carrying on polymerization for a suffcient length of time, and it may be obtained somewhat more quickly by using incompletely purified vinyl chloride, without solvents. That is, the raw vinyl chloride not purified by fractional distillation, but with only the gaseous admixtures removed is used.

These admixtures, particularly acetylene, should be removed, since otherwise they cause a considerable increase of pressure in the polymerization apparatus. Vinyl chloride of this character will contain a small quantity of admixtures of high boiling point (halogen compounds), and the catalysts which accelerate the change to alpha to beta to delta to gamma.

Methods of Conversion

I have also discovered that by careful continuous heating of the alpha modification, either in solution or pure, to a temperature such as 50° to 135° C., the alpha modification is converted into the beta. Also a sufficiently continuous exposure to light, as for instance, the ultra-violet rays of a mercury quartz lamp, or the rays of an electric arc (carbon, etc.) will convert the alpha into the beta modification. If the heating, or the subjection to light, or both together, of the original alpha modification is continued for a considerable period of time, the first formed beta modification will first be converted into delta and later into the gamma modifications.

The insoluble modifications above mentioned (delta and gamma) may be transformed into the beta by means of those solvents which partially react chemically upon the caoprenchloride. Among these are various amines, such as aniline oil, pyridine, lutidine, toluidines, xylidines and the like are also suitable for the purpose. Such nitro compounds, as for instance, nitrobenzol, and other compounds such as acetophenone and the like are also very useful for this purpose, and are capable of converting the insoluble modifications into the soluble.

In using aniline, for instance, it is added to the mixture until a solution is obtained.

When the insoluble modifications are treated with any of the substances above indicated, the delta modification is converted into the beta. That the product is the beta modification and not the alpha may be demonstrated by treating the solution with alcohol, which precipitates the caouprenchloride, and the precipitate is readily soluble in chlorobenzol, but not in acetone. Hence, the reaction provides a convenient process of obtaining the beta modification, by transformation of the delta. In order to purify the product and remove pigmenting mixtures, the precipitate should be thoroughly washed in alcohol.

The treatment of the insoluble modifications with aniline

SOLUBILITIES OF POLYMERIZED VINYL CHLORIDE RESINS

Solvent	Alpha	Beta	Delta	Gamma
Xylol	Slightly soluble	Swells	Swells slightly	
Chloroform	Dissolves	Swells	.....	
Ethylene di-chloride	Dissolves	Swells	Swells slightly	
Tetrachloroethane	Dissolves easily	Dissolves	Swells rapidly	
Chlorobenzol	Dissolves easily	Dissolves	Swells rapidly	
Chloroacetone	Dissolves easily	Dissolves	.....	
Di-chloroacetone	Dissolves easily	Dissolves easily	Swells	
Orthochlorophenol	Dissolves easily	Dissolves	Swells	
Styrol	Dissolves	Slightly dissolves	.....	
Benzyl chloride	Dissolves	Dissolves	Swells	
Chloronaphthalene	Dissolves	Dissolves	Swells	Insoluble in any
Acetone	Dissolves	Insoluble	Swells	
Ethyl-methylketone	Dissolves easily	Dissolves slightly	.....	
Acetophenone	Dissolves easily	Dissolves easily	Swells rapidly	
Ethylacetal	Slightly dissolves	.....	.....	
Ethyl-acetoacetate	Dissolves easily	Dissolves easily	Swells	
Ethylbenzoat	Dissolves easily	Dissolves easily	Swells rapidly	
Chloral	Dissolves easily	Dissolves	.....	
Benzaldehyde	Dissolves	.....	.....	
Pyridine lutidine	Dissolves easily	Dissolves easily	Swells	
Benzylaniline	Dissolves	Dissolves	Swells	
Aniline	Dissolves easily	Dissolves easily	Swells rapidly	
Nitrobenzol	Dissolves easily	Dissolves easily	Swells	
Trichloroethylene	Dissolves	Slightly dissolves	.....	
Glycol-di-acetate	Dissolves	Dissolves	.....	
Anisole	Dissolves	Dissolves	.....	

and the like is in the usual manner, the reagents being mixed, preferably with some increase in temperature.

If in any reaction a mixture of soluble and insoluble modifications should appear, they may be readily separated by filtration through a suitable medium, or by centrifugal action. The different modifications of polymerized vinyl chloride or caoupren chloride are distinguished from each other not only by various properties of solubility, but also by many differences in physical properties. For instance, the delta modification, while insoluble is capable of swelling in various substances, as for instance, tetrachloroethane, chlorbenzol, ethyl benzoate, and aniline. While the insoluble modifications make a strong and colorless sheet, for instance, the surface is usually rippled and with local inflations or tubercles. The beta modification is particularly adapted for the making of sheets or strips in that it provides a very flexible elastic strip or sheet and with a non-light-refracting surface. The alpha modification is chiefly useful in the manufacture of celluloid and ebony-like products.

For Film Base

When making film supports from caoupren chloride with a halogen compound, I have discovered that the plastic properties are greatly improved by the introduction of alpha and beta chloronaphthalenes or their mixtures; by symmetrical tetrachloroethane; or by dichlorobenzol. The alpha chloronaphthalene or the di-chlorobenzols may be introduced into the solution in comparatively small quantities, or they may be used in the process of making films as the solvents, either with or without other halogen compound.

I have discovered that the beta modification prepared by means of a chlorbenzol solvent when made into film support absorbs a quite substantial quantity of the solvent; yet when

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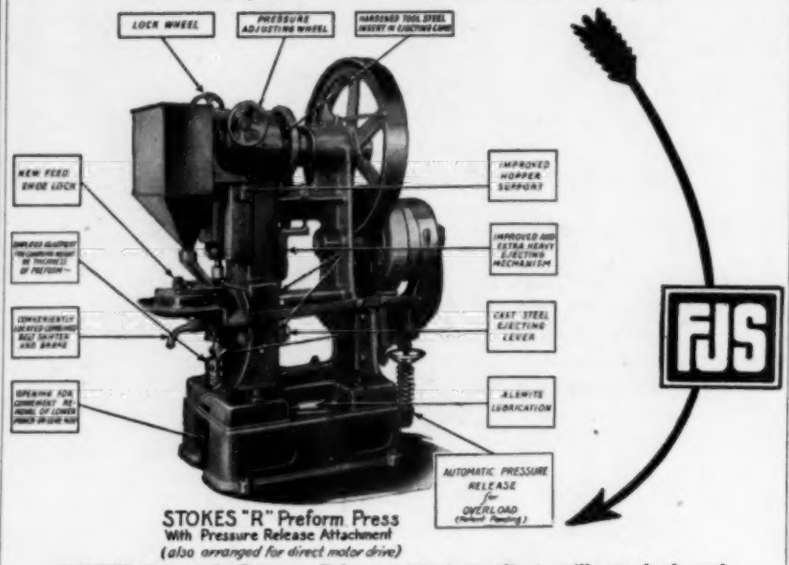

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said supports contain 50% or more of the solvent, they possess very valuable plastic properties. However, the films prepared from solutions of caoupren, chloride in pure monochlorbenzol tend to dry out in the course of time, and thus become brittle. Therefore, it is necessary to introduce into such solutions small quantities of such compounds as for instance, dichlorobenzol, alpha chloronaphthalene, acetophenone, etc.

To simplify the making of film support, it is advisable to polymerize the vinyl chloride in solution with a solvent used in manufacturing of films, as for instance, chlorbenzols, or symmetrical tetrachloroethane, and the like. Very good film supports may be obtained even from very weak solutions of beta modification, such for instance, as 6% to 30%.

Alpha Form Uses

The alpha modification is the most suitable for making ebonies because it gives a homogeneous structure which has very high tensile strength. The beta modification is suitable for ebonies, as well as for films. The delta and the gamma modifications, while unsuitable for films, are suitable for ebonies, but do not give so perfect products as the alpha modification. The tensile strength is not so great, and the structure is not so homogeneous.

In my first experiments with polymerizing vinyl chloride, I discovered the existence of two modifications, and described the same. These modifications I described as alpha and gamma, respectively, the former being soluble and the latter insoluble. Later I discovered two other modifications between the alpha and gamma, so far as regards solubility and order of appearance. Necessarily, these modifications were designated as beta and delta. Hence the designations of the modifications, so far as concern solubility and order of appearance, do not hold their usual order as found in the Greek alphabet.

Resinoids in Dentistry

(*Continued from page 444*)

The mold may consist of equal parts of gypsum and pumice stone powder, or silicate masses such as quartz powder.

British Patent 249,223, Dec. 22, 1924. See United States Patent 1,585,358 to Hick.

British Patent 258,674, June 27, 1925. See United States Patent 1,669,557 to Grainge and Wilding.

British Patent 260,319, June 27, 1925. See United States Patent 1,718,019 to Wilding.

British Patent 261,447, July 14, 1925. An artificial denture is made from a condensation product of equal parts by volume of phenol and formaldehyde with a condensing agent such as 2 to 3 per cent hydrochloric acid (33% strength) or 4 to 6 per cent of concentrated sulphuric acid or oxalic acid at 70°C. The product is a solid thermoplastic and may be incorporated with dyes or pigments at any stage. The composition may be molded in ordinary plaster molds and hardened in manner or rubber. Product may be used alone for the entire plate or in combination with rubber as a gum facing and may be cured simultaneously with the vulcanization of the rubber. The product may also be used in combination with metal. A variation consists in making the plate of the produce and coating with rubber. The product may be used for taking the bite and can be kept from hardening by protective film of wax or solution of collodion or rubber in chloroform.

British Patent 262,410, Nov. 12, 1926. Dental plate may be made of a mixture of solid and liquid Bakelite. Exposed portion of the entire denture may be made of this mixture containing also wood flour, lithopone, zinc oxide and dye or pigment such as toluidine toner. Denture itself may be made of the dark colored mixture coated with dental rubber or opaque pink varnish.

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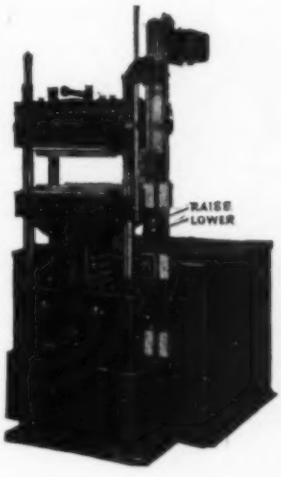

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TECHNICAL ABSTRACT SECTION

A Review of Literature and Patents

Carbohydrate Resinoid and Process of Making Same. Joseph V. Meigs, of Boston, Massachusetts, assignor to Meigsoid Corporation, of Jersey City, New Jersey. U. S. P. 1,801,053; April 14, 1931.

A process of making a chemical product adapted for use as resinous or insulating material, which comprises reacting a carbohydrate with a reactive nitrogenous basic body in the presence of acidic material and thereafter incorporating a hardening agent.

Example

	Parts by Weight
Corn sugar	400
Aniline	200
Water	200
Oxalic acid crystals	6

The above ingredients were heated under reflux for three hours and yielded a viscous, resinous mass which was washed with water and dehydrated by heating to 110 degrees centigrade. Above this temperature polymerization and consequent hardening set in. The hardening of this material is accelerated by the presence of citric acid as well as by the action of hexamethylenetetramine. The product also reacts vigorously with oxidizing agents, as for example, potassium bichromate, and is hardened thereby.

A product prepared as in Example 5 has the property of dissolving casein. 200 parts by weight of a product prepared as described above were heated to 70 degrees centigrade and mixed with a solution of 60 parts by weight casein in 20 parts by weight of water and 9 parts by weight strong ammonia. The resulting product was dehydrated at 110 degrees C. 200 parts by weight of it were mixed with 50 parts by weight of wood flour and 20 parts by weight of magnesia, on rubber mixing rolls. The resulting mixture was cured for 10 minutes in a mold at 20 lbs. steam pressure and under a compression of 2000 lbs. per square inch. The resulting molded article was hard and tough, and black in color.

Manufacture of Composite Glass. Herbert John Mallabar, of Watford, England. U. S. P. 1,802,213; April 21, 1931.

A method of forming composite sheets of glass and cellulose acetate by treating the faces of the cellulose acetate with a volatile softener, applying to said faces a solution of gelatine, drying to produce a strongly adherent layer of gelatine, treating the faces of the glass sheets with a very thin layer of a solution of gelatine containing a hardening agent, drying said solution applying a solution of gelatine, drying to produce a strongly adherent layer of gelatine, applying a volatile softening liquod to said gelatine layers and uniting said cellulose acetate to said glass sheets by pressure.

A composite sheet of glass and cellulose acetate containing the following layers in the order specified: glass, hardened gelatine, gelatine, cellulose acetate, gelatine, hardened gelatine, glass.

Splinterless Glass. Alphonse Gams and Gustave Widmer, of Basel, Switzerland, assignors to the Firm Society of Chemical Industry in Basle, Switzerland. U. S. P. 1,802,246; April 21, 1931.

A colorless artificial compound glass consisting of several sheets of condensation products of carbamides and formaldehyde, homogeneously connected together, the inner layer or layers being of softer material than the outer layers.

Example 1

A. 5 kilos of urea are dissolved in 12.7 litres of formaldehyde of 40 per cent. strength and the solution is filtered after addition of 0.6 kilo of animal charcoal. The solution is then heated for 8 hours in an autoclave at 100° C. and then evaporated at a low temperature; it is finally cast into moulds after addition of 0.01 kilo of phosphoric acid in syrupy form and hardened by increasing the temperature.

B. The proceeding is as described under A, but together with phosphoric acid there is added 0.5 kilo of benzyl alcohol as a softening agent.

When the hardening has proceeded so far that the glassy mass can be worked, thin sheets are cut and a sheet of B is laid between two sheets of A. This combination of layers is then pressed for 1 hour at 100° C. and 50 atmospheres pressure. The plate thus obtained is further hardened in the usual manner until polymerization is complete.

Example 2

The materials made in accordance with Example 1, A and B are hardened only until they form solid, glassy jellies. They are then cut into layers and the latter are put together as described in Example 1 and united by light pressure in a rolling machine, whereafter they are hardened to form a finished product.

Synthetic Resin and Method of Making the Same. Emil E. Novotny, of Philadelphia, Pennsylvania, assignor to John Stogdell Stokes, of Spring Valley Farms, Huntingdon Valley P. O., Pennsylvania. U. S. P. 1,802,390; April 28, 1931.

This example, together with the two other examples following, illustrates the use of a mixture of resorcin or hydroquinone plus an active methylene body as a hardening agent for previously made synthetic resin products or mixtures of these with filling materials in the form of, say, molding powders.

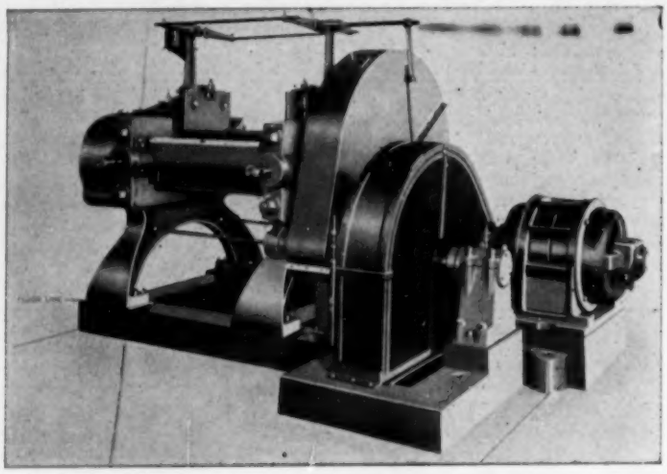
Phenol furfural basic catalyst resin	10
Equimolecular weights of resorcin and paraformaldehyde	½ to 1½

Proportions given are all parts by weight. Mix thoroughly either in a dry state or in solution in a varnish or introduce on the mixing rolls in order that a uniform mixture will be obtained. The product upon being heated at temperatures somewhat over 310° F. will melt down and the entire mass will go to a state of infusibility and insolubility in an extremely short time. The product has the advantage over hexamethylenetetramin in that no catalyst is really necessary so far as the hardening reaction is concerned and that at the same time the reactivitity of the mixture of resorcin and paraformaldehyde is much more rapid than if paraformaldehyde were used alone. The addition of resorcin alone will help to speed up the reaction, but I find it preferable to add the paraformaldehyde as the greatest speed is thus obtained. The product has a further advantage in that fewer flow marks are caused on the surface, and the finish of the mold is kept clean and polished. As a matter of fact, this mixture when introduced into suitable filling materials makes a very satisfactory medium for the removal of mold stains. Because of the intensive study the applicant has made in connection with resins made of various phenolic bodies and furfural, this resin was preferably shown as an example. It should, however, be understood that other types of synthetic resins such as, for example, those made of phenol formaldehyde, phenol carbohydrate, phenol acetaldehyde, or phenol acetylene can be used in place of the resin mentioned.

Electrical Insulating Material. Joseph Edouard Gustave Lehousse, of Lyon, France. U. S. P. 1,802,517; April 28, 1931.

Example 1

About 10 kgs. of paratoluenesulphonamide, which melts at 136° C., are heated in an iron vessel to 150° C. 90 kgs. of resin are added, and after complete fusion, the mass is heated to 170° C. Then the zinc oxide (sold commercially under the name of "zinc white" for painting purposes) is added, but in a progressive manner, in order to prevent too great an abundance of the froth formed by the reaction. This is continued until the froth disappears and the temperature has been raised little by little to 185-190° C., during which time 2.4 kgs. of zinc oxide have been added. The mixture thus obtained is then ready for use, and into it are plunged the paper condensers or the pasteboard tubes, or any other objects to be impregnated, which are left therein for about four or five hours, the temperature being kept between 150 and 200° C. Thereafter the temperature is allowed to drop,



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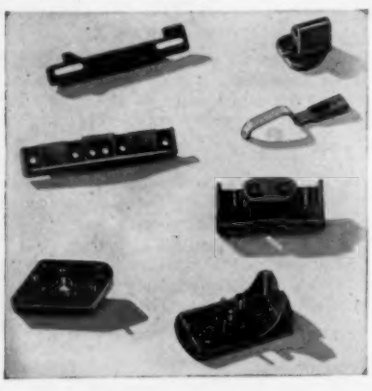

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and when it has fallen to about 120° C., the articles are withdrawn and left to cool completely.

Resinous Condensation Product and Method of Preparation. Edward S. Dawson, Jr., of Schenectady, New York, assignor to General Electric Company. U. S. P. 1,803,174; April 28, 1931.

A method of preparing a resin which consists in heating a mixture of glycerine, phthalic anhydride and a small proportion of sulphuric acid until reaction occurs, forming a resinous product, adding a fatty acid derived from a drying oil and said product and continuing heating until miscibility of the resinous product and the acid occurs.

A method of preparing a resin which consists in heating about ninety-two parts of glycerine, about two hundreds parts of phthalic anhydride and about 10 c. c. of concentrated sulphuric acid until a resinous product is formed, adding about seventy parts of eleostearic acid and continuing the heating until said acid combines with said resinous product.

When this resin is heated for a sufficient length of time, it becomes infusible and insoluble and has a hard glass-like surface, while possessing considerable flexibility. It is tough and strong and therefore well suited for use as a binder in moulding compounds, as a wire enamel, and as a protective coating for metals. The resin is resistant to moisture, oil and acid. It is also highly adhesive to metal surfaces. It may be applied either by spraying the parts to be coated or by dipping them into the fluid resin.

Production of Trialkyl Phosphates. William J. Bannister, of Terre Haute, Indiana, assignor to Commercial Solvents Corporation, of Terre Haute, Indiana. U. S. P. 1,799,349; April 7, 1931.

A process for the production of trialkyl phosphates, the steps which comprise slowly adding a benzol solution of phosphorus oxychloride to a benzol solution of aluminium alkoxide while maintaining the temperature of the reaction mixture below about 15° C., then slowly adding sufficient water to hydrolyze any aluminium chloride and phosphorus oxychloride present while regulating the temperature of the reaction mixture, and finally removing the water and recovering the trialkyl phosphates by fractional distillation.

Castor-Oil Condensation Product and Process of Making the Same. Edward C. Holton, of Olmstead Falls, Ohio, assignor to the Sherwin-Williams Company, of Cleveland, Ohio. U. S. P. 1,799,420; Apr. 7, 1931.

A method which consists in destructively distilling castor oil until the residue is from sixty to eighty per cent of the original weight of the castor oil, heating the residue with the addition of one-half to three times its weight of glycerine until the esterifiable constituents of the residue are substantially esterified,

and then heating the product thus obtained with from three-fourths to five times the weight, of said residue, of phythalic anhydride until condensation takes place and the mass becomes homogeneous, clear and almost tranquil.

Process of Making Water-Soluble Phenolic Condensation Products. Edward Sidney Hole, of London, England. U. S. P. 1,799,816; Apr. 7, 1931.

Example

Carbolic acid (phenol) .....1 cwt.
Formaldehyde 40% .....1 cwt.
Potassium hydroxide (KOH) 2½ lbs.

The mixture of these constituents is placed in a still and boiled for a period which depends upon the purpose for which the mixture is intended. When the mixture reaches the boiling point a visible seething appears and after this a period of 30 to 40 minutes continued boiling is sufficient to produce a product suitable for most purposes. The viscosity of the solution increases during the boiling at first slowly and then so rapidly that relatively fine adjustment of the period of boiling is necessary in order that the desired degree of viscosity may be obtained, for whereas after the boiling point is first reached a few minutes do not effect any noticeable change, in the later stages a single minute may visibly affect the viscosity of the product.

Instead of eliminating or simply neutralizing the alkaline condensing agent (which if not suitably treated would continue to operate even in the cold) utilize this alkali as a basis on which to build a compound of chromium, the effect of which is to suspend the activity of the condensing agent rather than to neutralize it altogether, and at will it can be made again effective in the last and most important stage of resinification, reinforced by the action of the chromium and oxygen contained in the chromium compound which has been embodied in the product. The effect is that the finished product is endowed with remarkable strength and is produced with remarkable ease.

As a typical example of the employment of a compound of chromium, I may add to the cooled solution of phenol formaldehyde prepared as above described a mixture of 2-3 pounds of ammonium dichromate, 36 lbs. of cold or warm water and sufficient ammonium hydroxide to prevent precipitation. When the viscosity of the mixture is very high, alcohol, either alone or in combination with ammonium hydroxide, may be added to the mixture to ensure solubility.

Urea Condensation Product. Oscar A. Cherry, of Chicago, Illinois, assignor to Economy Fuse and Manufacturing Company, of Chicago, Illinois. U. S. P. 1,799,954; Apr. 7, 1931.

The incorporation of a small quantity of sucrose or cane sugar in the urea condensation product at any stage of its production prior to that of gelatinization, eliminates the tend-

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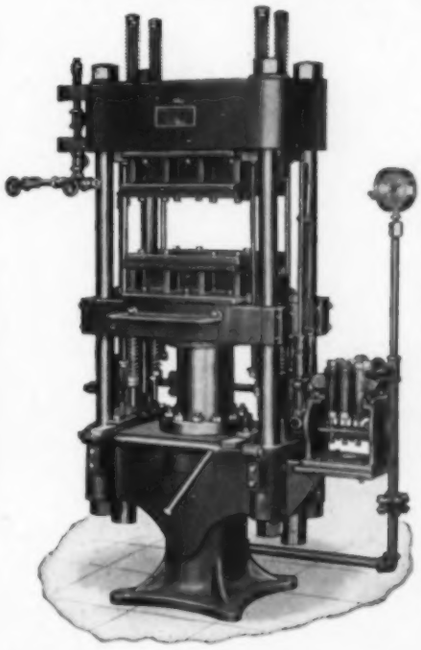

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The Cambridge Mold Pyrometer is a production instrument providing an accurate means of determining exact mold temperatures. Standard range is 50°-400° Fahr. Additional ranges up to 900° are furnished.

Our new catalogue 194-SP, describing Cambridge Surface Pyrometers and their industrial applications, is now available. A copy will be gladly sent upon request.

CAMBRIDGE
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Pioneer Makers of Precision Instruments
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New York

ency of the molded articles to crack during the hardening operation.

Example

To three hundred and fifty parts by weight of commercial forty per cent formaldehyde is added ten parts by weight of zinc dust and the whole is heated to boiling under a reflux condenser and the source of heat is withdrawn. Upon cessation of ebullition one hundred parts by weight of urea are added. If desired the urea may be added in small portions but this is unnecessary. The solution is heated to boiling under the reflux condenser. If a large quantity of materials is being treated cooling may be employed to minimize the vigor of the reaction. The reaction will have progressed sufficiently in a few minutes when the liquid may be filtered to remove the excess metal. Preferably decolorizing carbon is added before filtration to remove the objectionable color, usually present in commercial formaldehyde.

After filtration the solution is distilled at atmospheric or reduced pressure until the major portion of the water has been removed. At this point 20 parts by weight of sucrose are added and the distillation is then continued until a product of suitable viscosity for casting or molding is obtained. The product is then heated in the mold or molds at preferably from fifty degrees to sixty degrees C. Somewhat higher temperatures may be employed but if the molded object is quite large, it is not desirable to exceed these temperatures in the early stages of the heating. Unlike urea products made without the addition of sucrose, the heating may be continued to the point where the material has attained its maximum hardness without danger of cracks or fissures forming.

Condensation Product and Process For Preparing Same. Herbert Hönel, of Vienna, Austria, assignor to Beck, Koller & Company, of Detroit, Michigan. U. S. P. 1,800,295; Apr. 14, 1931.

A product obtained by reacting a substantially neutral resin and a non-resin-like condensation product which may be obtained from a phenol with a hydrocarbon radicle substituted in the para-position.

A product obtained by reacting a substantially neutral resin and a non-resin-like condensation product obtained from a phenol with an alkyl radicle substituted in the para-position, which substituted phenol has been condensed by means of formaldehyde in the presence of an alkaline catalyst.

Example 1

82 grms. of p-tertiary-amylphenol (prepared for example from equimolecular proportions of phenol and tertiary amyl chloride, with a little $AlCl_3$) are dissolved to a clear solution in 90 grms. of 30% formaldehyde and 75 cc. of 3n-NaOH, by gentle warming. The charge is maintained at 50-55° C. for about 24 hours, and the viscous oily reaction product is precipitated by any acid, separated from the supernatant aque-

ous liquid and dried in the water bath. When placed in moulds it can be transformed, under pressure (in autoclaves), into a very hard, infusible resin. Before and after this treatment it is extremely fast to light.

Artificial Mass and Process for Making Same. Herbert Hönel, of Vienna, Austria, Assignor to Beck, Koller & Company, of Detroit, Michigan. U. S. P. 1,800,296; Apr. 14, 1931.

A process of making a soluble artificial mass, which comprises causing to react a substantially neutral ester-like body not rendered infusible by absolute esterification, by heating said ester-like body with a non-resin-like condensation product of comparatively low molecular weight obtained by alkaline condensation from formaldehyde and a phenolic body, which phenolic body has at the utmost two substituted particularly reactive positions, the said ester-like body being used in greater proportions than the said phenol formaldehyde condensation product.

New Improved Durez

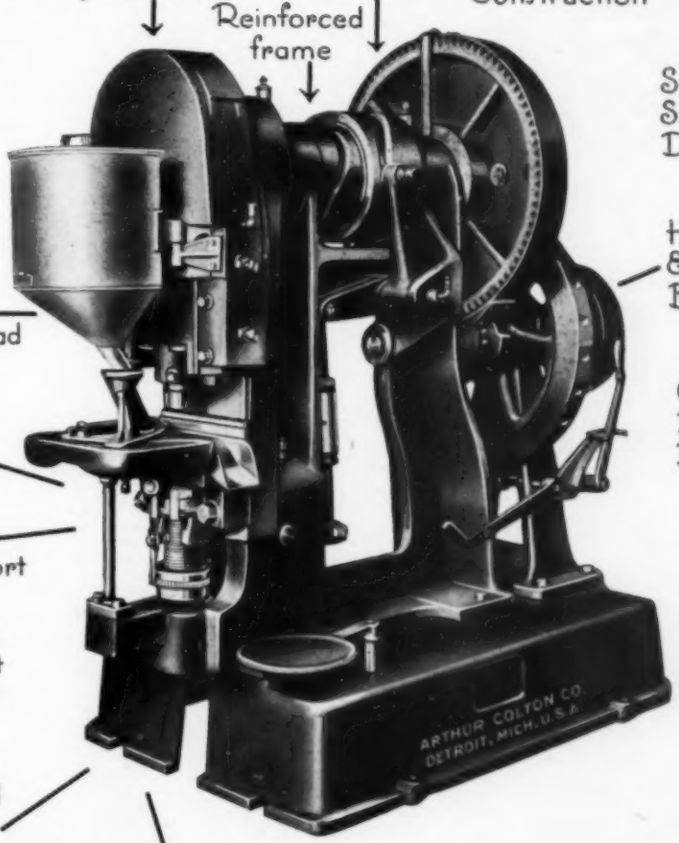
(*Continued from page 457*)

than before, grade for grade, yet giving a much faster cure than previously); thinner fins; and even less tendency toward dog-skinning and similar defects. Prices remain the same. Tests have shown that the new Durez brown cured completely in a two-minute cycle, with high lustre and thin fins, whereas, on the identical part, an ordinary phenolic compound of reputedly the same plasticity barely cured in a four-minute cycle.

Corn Products in Resinox

An announcement was recently made of the acquisition by Corn Products Refining Co. of a substantial interest in the Resinox Corporation, Metuchen, N. J., manufacturers of phenol formaldehyde resins. Resinox was hitherto a wholly owned subsidiary of the Commercial Solvents Corp. G. M. Moffett and F. M. Sayre join the Resinox board.

A NEW IMPROVED PREFORMING PRESS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FOREMAN-MANAGER WANTED

Thorough, experienced mold-maker, designer, estimator, to take full charge of plant. Must know tooling, dies, and handle large variety manufacturing. Capable direct production under stiff competition. Old firm recently allied with major national organization. Reply to Plastics, Box 571.

WANTED

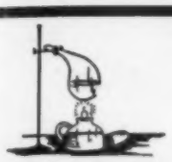
Molding presses and accessories for hot molding phenolic and similar materials. Send complete specifications and location of machinery to Plastics, Box 572.

CHEMIST

Long and thorough experience on research and development of plastic compositions and synthetic resins, desires connection. Reply to Plastics, Box 573.

SALESMAN WANTED

Experienced, to develop market for a new Bakelite product, having a very wide usage and adaptability. Should be familiar with laminated Bakelite market. State age, experience and salary expected. Reply to Plastics, Box 574.



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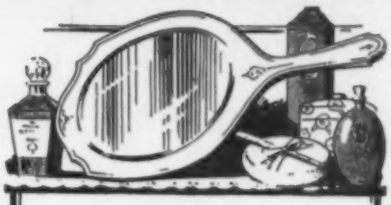

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Cross, C. F.—Doree, Charles—Researches in Cellulose Vol. 4	1922	263	6.00
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Wilson, S. P.—Pyroxylin Enamels and Lacquers	1927	253	3.50

Other books quoted on request.

Book Department, Plastics --- 114 E. 32nd St., New York

And Now, In Closing:

IT is our doubtful pleasure to make a few corrections of July reporting . . . Associated Attleboro is *not* related to Liberty Molding . . . . Colonial Molded Products is still running the Plainville plant though the New York office is no more . . . . Another Royal Molding Company comes in the game . . . this time in Chelsea, Mass. . . . Durez is using a new type drum and expresses satisfaction . . . . The new Faoen (Park & Tilford) perfume selling in Woodworth's has two new-style closures . . . . Other good (and new) five-and-dime plastics are some circular bridge ash-trays with snuffer, stylish coasters, salt and pepper shakers . . . . This month our Own Harvard Award goes to the molder who is making a profit on urea—"Non-shatterable" tumblers that retail at ten cents . . . . On July 22, Corn Products Refining Company acquired a substantial interest in Resinox Corp . . . . to date Resinox has been a wholly owned Commercial Solvents subsidiary . . . . And it will be remembered that Corn Products were in the same jam with the government that U. S. Industrial Alcohol and R. & H. are in now on alcohol . . . Plastics appeared on the front cover of Printers' Ink (July ninth) . . . if interested address North Tonawanda (Adv.) . . . . There are too many vacations to give a list . . . . perhaps some of them will be the "sic" transit variety . . . . However, lots of money has been spent recently . . . . the demon statistician says there was $3,836.43 spent alone on trips to Detroit!

MEN in the plastic industry and particularly in molding, either overlook, or are unaware of, one strong reaction to their internal disturbances. *The consumer is losing confidence.* Since the consumer is the actual source of all our pay checks, we have been talking to him—and *listening* to him—during the past month. His reaction is not based solely on the disturbed price situation that has existed for some time, but on the attitude and feelings of the entire industry. Reverberations concerning the disturbing elements within the industry, their half-hearted efforts for concentration, the adoption of uniform rules by some and their rejection by others, the almost "stock-selling" industrial salesmen,—all these make their impression upon him and influence his future attitude. You and I know, or believe we know, that there is a steady birth rate within the component factors of the industry resulting from such disturbances; that there is many a consumer "on his own," often at a loss, through misunderstanding or as a result of this same aforementioned "stock-selling." There will always be a superabundance of disturbers; men who are willing to foreclose on property not their own. But there is also the possibility that, through boredom and loss of business, the disturbed element will grow smaller. Talks and conferences may be cheap, but they often teach an expensive lesson—to the consumer! The industry inspiring his confidence usually gets his orders. At this writing it seems as though our industry is doing everything possible, through its policies, to stimulate distrust. If our clientele dissents from this opinion, that is their privilege. It is an opinion based on specific facts.

CONSIDERABLE gloss and glamor have been removed from the packaging field. So many fabricators and molders jumped into this for the sole reason that "John has more business than I have, and he gets a lot of it from packaging." A market survey, to some, never meant more than following the wife shopping, and any effort to style to the consumers' needs was unthinkable. The cry was "style to our needs and limitations." Yes, the glamor is gone, but the profit is beginning to come as a result—and we don't mean prophet, either, as Harry Addison would say. Sound consulting advice, based on the needs of mankind, is an investment, not a speculative issue.

WE again, in sounding out the condition and causes of business, before and after, turn to the A. P. P. A. Weekly for a lesson in good common sense.

"Price is something more than a mere indicator of value; it is a barometer of the market. It is this because it expresses the ratio between the two chief constitutents of a market. Price alone, with no embellishing statistics whatsoever, describes a market. It has done this since men began to do business with one another.

How can price, the embodiment of flexibility, be reconciled with mass production, the essence of rigidity? The answer lies both in making the price structure more rigid and in making production more flexible.

No one worries particularly about prices until they approach or sink below costs. But the near approach of prices to costs is signal enough for worry and gloom—with which all are now well acquainted. When such a condition comes about, the price barometer signals danger. The corrective action is simple: ease off on production until prices rise, meanwhile producing and selling goods which both in kind and quantity can be sold above cost."